HYGIENE FOR NURSES

THEORETICAL AND PRACTICAL

HERBERT W. G. MACLEOD

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BY

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PREFACE

I HAVE endeavoured in the following pages to explain, simply and concisely, the most important facts in Hygiene which are essential to a Nurse in her daily work.

The information, it is hoped, will also be found useful to those who desire to obtain a Certificate in Hygiene, which it is an advantage to every qualified Nurse to possess.

It has been my desire to make this little book practical and up-to-date. Some very recent Regulations and By-laws of the Local Government Board and the London County Council were inserted as the pages were being finally revised. I am indebted to the medical papers—the *Lancet* and *British Medical Journal* in particular—for much valuable information.

Attention is directed to the Sanitary Laws of England, Scotland, and Ireland useful to Nurses in all parts of the British Isles; and a Summary of those Acts of Parliament of special importance to them is given in the Appendix.

The information as regards the Sick-room, details concerning Ventilation, Heating, Lighting, and Drains are intended to be of practical value to the Nurse when treating a case in a private house.

Water-supplies and fittings, Drainage, &c., have been described at some length. The subject is a difficult one to explain, and long experience as a Lecturer to Post-Graduates (and to Nurses) has shown me the advantage of practical demonstrations for imparting information. As modern Sanitary appliances cannot always be inspected by readers far away from towns and special Museums (such as that of the Royal Sanitary Institute, London), I have, in order to obviate the difficulty as much as possible, freely illustrated the text. With few exceptions, the drawings have been specially made for this work, and they are chosen as good types of the different subjects they represent.

As much space as available is devoted to the consideration of Infection and Disinfection. The way in which "Consumption" is spread, and the means of checking this, are kept prominently in view.

A Table of the chief Infective Fevers has been drawn up, and it gives the usual periods of Incubation, Eruption, and Infection, with the important early signs of each Disease. It is hoped this will be useful to Nurses.

Food and Milk are carefully considered, and simple tests are mentioned for detecting signs of contamination and adulteration in certain articles of diet.

Some of the numerous ways of the trade are explained. That such are constantly being practised, unknown to the Public, by some dealers and salesmen who do not act on the principle that "honesty is the best policy," is, unfortunately, too true. I therefore think it advisable to put Nurses and the Public on their guard.

The legal responsibility and powers of the Sanitary Authorities and Medical Officer of Health are outlined for the purpose of emphasizing how wide a control they have over the Public in general and the private individual in particular; and this is made more evident in the Appendix.

Personal Hygiene has been considered under different headings, *e.g.*, Baths, Clothing, Games, Exercises, Habits, &c., and the vagaries of Fashion have been given such notice as they merit from a purely hygienic point of view.

The question of Alcohol has been discussed; and Infant Hygiene, Bathing and Feeding, and Infant Mortality are referred to in detail.

I am aware of the difficulties of confining a wide subject within narrow limits, but I hope that what has been written will be helpful to those for whom it is

primarily intended, and that it will also be of some interest to the general Public.

In conclusion, I desire to express my thanks to those who have kindly made the sketches; to the Engravers for the care taken in preparing the illustrations; to the Publishers for the courtesy and interest they have shown in seconding my suggestions, and to the firms mentioned below for placing facilities at my disposal for the selection of illustrative types.

HERBERT W. G. MACLEOD.

LONDON, W., *May* 1911.

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The Illustration on the Cover is taken from the Bronze Statuette of Hygieia in the British Museum (Graeco-Roman period, 1st to 3rd Century A.D.).

HYGIENE FOR NURSES

CHAPTER I

AIR—PURE AND IMPURE

Hygiene is the Science of the Preservation of Health and of the Prevention of Disease.

It teaches us how, under suitable conditions, Life may be prolonged to its farthest limit.

It is also known as "Preventive Medicine" (because it is a branch of Medicine concerned in the prevention of Disease) and "Public Health" (because of its care of the health and well-being of the General Public). The name of "State Medicine" is also applied to it, as every civilised Government is bound to frame Laws and Regulations which are directed to benefit the health of the Nation.

Although Hygiene has only been properly attended to during comparatively recent years, it is a very ancient science. It derives its name from Hygieia, daughter of Æsculapius, who was himself a celebrated physician. She was greatly honoured by the Ancients as Goddess of Health; temples and statues

were erected to her all over Italy and Greece. She is represented as a young woman holding a cup, out of which a serpent drinks. In the British Museum there are two bronze statuettes of Hygieia.

The preservation of health is of importance, not only to every single person, but to a Nation as a whole. This point is not sufficiently realised. When the principles of Hygiene are neglected, degeneration, disease, and death will follow as a necessary consequence. To all Nurses, who will work among the Sick, this Science and its practical application will be of the greatest importance. The Public, in all countries, know unfortunately very little about the preservation of Health, and yet its principles can be easily applied in the daily life of all classes of Society with the greatest benefit. Brilliant results have already been obtained by the wider extension of this knowledge. Such terribly fatal diseases as Smallpox, Plague, Typhus Fever, and Hydrophobia have been stamped out in many places by applying the principles of Public Health. The number of deaths caused by "Consumption"—that national scourge, which kills thousands of people in the prime of life every year—has been greatly diminished, and is now becoming less, without doubt by better methods of Hygiene being used. For this reason, also, the average length of life of men and women in this country has been extended by several years. This

is proved by accurate figures obtained every year by the Registrar-General of Births and Deaths. By comparing the results of the last ten years with those of former periods, it is clearly shown that people live longer. Much more can be done by the spread of education in general, and by a wider knowledge of the Laws of Health. The most important causes which influence our Health, and which to a certain extent are under our control, are both Natural and Artificial agencies. They are Air, Ventilation, Light, Heat, Water, Food, inhabited - Buildings, Drainage. Among "personal factors" are our Habits, Clothing, and mode of life. Each one of these, to a greater or less extent, influences our liability to Disease. We shall in this order consider them in detail. In our daily life each must have its own place for the best results to be obtained.

We shall first consider Air in its pure, and next in its impure condition.

AIR

I. Pure Air

Pure Air is composed principally of two gases, Oxygen and Nitrogen, which are found mixed together throughout the world in almost exactly the same proportions. In one hundred volumes

of dry and pure air, there are nearly 21 of Oxygen and 79 of Nitrogen.

Oxygen is *the* gas which supports life. Without it both animal and vegetable vitality on this earth would cease. If inhaled pure and undiluted, it acts as an irritant; if air be breathed which contains an insufficient quantity of this gas, weakness, headache, pallor, ill-health, and disease will follow. If the amount is much below that found in Nature, suffocation and rapid death result. It is to be noted particularly that the Oxygen must be present in *sufficient quantity*—that is, about 21 parts per 100 of air—and properly diluted. In Nature, *Nitrogen gas acts as its diluent,* and they are always found together. Nitrogen, under ordinary conditions, does not enter the blood. Oxygen, as we know, does so in the lungs when we inhale air, and so purifies the blood, turning the dark-red fluid in the veins into the bright-red blood of the arteries, which is supplied to every part of the body. This gas is also used in Medicine in the treatment of Pneumonia and Asthma: in cases of heart-failure (as from Chloroform), and also in suffocation from poisonous vapours.

When air contains too little Oxygen, those inhaling it for any length of time in a badly ventilated room (whatever its size) suffer from headache and faintness. This is the frequent cause of such attacks in overcrowded buildings. About 16 parts

(instead of 21) per 100 of air will cause these symptoms. Workers long exposed to vitiated air are liable to serious illness, and are particularly likely to be attacked by "Consumption"—that is Tubercle of the lungs. A badly-ventilated bedroom is a source of danger to the healthy and to the sick. Nurses in charge of infectious cases in a room containing impure air run a great risk of taking the disease. It is therefore a matter of personal importance to them. If the amount of Oxygen in the inspired air is so small as 8 parts per 100, rapid suffocation and death from paralysis of the muscles of respiration will occur.

The absolute necessity, then, of keeping the air well supplied with this gas, as in Nature, will be evident to all.

How is the amount of Oxygen in the atmosphere kept constant in Nature? We must remember that, in breathing, the lungs take in Oxygen gas, and give out a certain quantity of Carbonic acid gas, otherwise known as Carbon di-oxide. It contains one part of Carbon and two parts of Oxygen, hence its name. It is denoted symbolically as CO_2, and is present in very small quantities in pure air—only about 3 parts in 10,000. This gas is exhaled by animals, and is given off whenever anything is burned, as by stoves and lamps. It is also passed into the atmosphere when animal and vegetable material decomposes or becomes "stale." Cut-

flowers should not therefore be left at night in a room in which people are sleeping. Carbon di-oxide in excess acts as an impurity in the air.. Living trees and plants absorb this gas, and use up the carbon in it for their own growth, but *give off the Oxygen*, returning it to the atmosphere, so that it can be breathed by Man and animals for the purification of their blood.

We see, then, how Nature removes this impure gas, and provides a pure one in its place—the Vegetable exchanging gases with the Animal kingdom. In this way the atmosphere is kept fairly constant in its composition throughout the world.

There are other influences also at work:

1. All gases have the peculiar power of *diffusing equally in all directions.* If kept in a vessel or contained in a room, each one of them will spread itself equally to every part of it, so that they will mix perfectly with the air after a certain time.

2. Another peculiarity they have is that *gases expand on heating*, and become lighter; and they *contract on cooling*, and are then heavier. Consequently a warm gas, or warm air (which is a mixture of gases), will rise to the highest part of a room, or will go up the chimney of a fireplace when heated. If cold air enters a room (as when the window is opened) it will descend to the floor-level, being heavier than the warmer air within. This is a most important thing for us to understand, as warming the air

is one of the best methods of obtaining good ventilation.

3. When the atmosphere is in motion, as when the wind blows, it forces its way along and pushes the air in front of it ("Perflation"), drawing more air behind it in its path ("Aspiration") and in this way stirring up all the air in its immediate neighbourhood. It therefore helps to mix up the gases in the air, and so renders them more uniform in their distribution. We know, therefore, that these six causes (the inter-action of animal and vegetable life; diffusion; expansion and ascension on heating; perflation and aspiration of the atmosphere) help to render the air of a practically uniform composition throughout the world.

The air is said to be "dry" when it does not contain "moisture," that is, the vapour of water. But in Nature there is always some invisible water-vapour in the air. When air is "damp" it contains a great deal of water, and this may condense and form a fog. Clouds are only visible masses of water-vapour floating in the atmosphere. When air at any temperature contains as much invisible moisture as it can hold, it is said to be "saturated": on cooling, this is deposited as dew or as fog. When air is warmed, it can take up or absorb a much greater quantity of water than when it is cool.

In very pure air, such as we find on moun-

tains, at the sea-side, and far out at sea, there is Ozone present in very small amount. It is a kind of condensed Oxygen. It is formed in Nature by the action of electricity on Oxygen, as by the lightning flash; and also by the friction of the surface of waves at sea against the atmosphere. Ozone is not found in air which is impure, and is usually absent in large towns where there are many factories. Its presence indicates that the air is pure, and Ozone is itself a disinfectant.

II. Impure Air

Air is rendered impure by Natural and Artificial causes.

Among the *natural causes* are Respiration, Combustion or Burning, and the Decomposition of Animal and Vegetable matter. The *artificial causes* are chiefly found in manufacturing, densely populated, and dirty towns; in them the air may be very impure. The dust from cotton- and woollen-mills, stone- and metal-works, and from coal-mines is inhaled, and causes much irritation and inflammation in the lungs. Poisonous gases are given off from various processes—such as salt-works, gas-works, and rubber-works. Carbon di-oxide is present in large amount wherever furnaces are used.

Nuisances are, as we know, caused by fish-shops, glue-works, and other places where offensive vapours

are given off, and in the slums of a town filth accumulates from overcrowding, and the un-hygienic habits and conditions of the people.

Dust from the street is also blown about. The germs of disease are carried by the air in the same way, and may come from dust-bins, sewers, and the roads, if dirt is allowed to accumulate and is not prevented from passing into the atmosphere.

In our own houses particles of skin, hair, saliva, clothing, &c., are carried in the air we breathe. Constant washing and suitable changes of apparel are therefore important points to be attended to. People do not appreciate the fact that sneezing, coughing, and even speaking aloud, scatter very small particles of mucus and saliva into the air. In this way the germs of disease may be communicated to others.

The following Infectious Diseases may be transmitted through the air. In some of them the area of infection is a "limited" one, that is to say, the infection is in the immediate neighbourhood of the patient, and does not travel far. Typhus Fever is an illustration of this. Infection can be conveyed for some distance through the air—Influenza, for example, spreads rapidly over large areas.

The most important Diseases so transmitted are given in the appended Table:—

Air-Borne Infectious Diseases.

Small-pox (*La Petite Verole*).
Chicken-pox (*La Petite Verole Volante*).
Measles (*La Rougeole*).
German Measles (*La Roseole Epidemique*).
Scarlet Fever (*La Fièvre Scarlatine*).
Whooping-Cough (*La Coqueluche*).
Mumps (*Les Oreillons*).
Diphtheria (*La Diphtherite*).
Influenza (*La Grippe*).
Erysipelas (*L'Eresipele*).
Tubercle of the Lung or "Consumption" (*La Maladie de Poitrine*).
Pneumonia (*La Pneumonie*).
Diseases of the Skin and Hair, *i.e.* Ringworm (*Teigne Tondante*) and Favus (*Teigne Faveuse*), which are caused by vegetable spores.

Some of these diseases, *e.g.* Measles and Smallpox, may be conveyed by other means, such as by infected clothing, Diphtheria by contaminated spoons and cups, and "Consumption" by milk containing the living-germs of Tuberculosis.

One or two other diseases, prevalent in Tropical countries, are conveyed by flying insects, and, therefore, not by the air itself. These are: Malaria (*La Fièvre Paludène*), the poison of which is communicated by a bite from a particular kind of mosquito (*Anopheles*); Yellow Fever (by a different species of mosquito); and Sleeping Sickness (by the bite of a fly).

CHAPTER II

VENTILATION—NATURAL AND ARTIFICIAL

VENTILATION is a subject which has only comparatively lately been properly studied, although it influences the health of persons at all ages of life. Unhappily it is true that even at the present time there are some Architects who do not know how to plan a building so that it will have efficient ventilation. In our churches and theatres and other places where large numbers of people assemble, the atmosphere is in consequence greatly vitiated. Many people, from ignorance of the facts, have a great objection to ventilation. They believe it causes exposure to draughts and chill. It is essential to understand that *neither draught nor chill is caused by proper ventilation.* It prevents both. Those who work as Nurses will have to meet all the objections that people will raise when one desires to ventilate their rooms, whether they be patients or healthy persons.

What, then, is proper ventilation? For the suitable ventilation of a room (whether it be occupied by the sick or the healthy, by children or adults)

the following Six important conditions are to be fulfilled:—

1. The air entering the apartment must be *pure in quality.*

2. It must be *sufficient in quantity* for every person in the room and for any lamp, candle, fire, or stove burning in it.

3. There must be a *continuous supply of fresh air.*

4. The air must *enter at a proper velocity,* to avoid draught.

5. It must be at a *suitable temperature* in the room, to avoid chill.

6. The *impure air* in the room must be *continually removed.*

We shall consider each of these separately.

I. Natural Ventilation

Ventilation is divided into Natural and Artificial. The first is produced (1) by the *natural movements* of the air, *e.g.* wind; (2) by *differences of temperature* in the air inside and outside a room; (3) by the *natural property of diffusing itself* which air possesses.

Artificial Ventilation is caused by forcing the air into or out of a room by *mechanical processes,* such as fans (*e.g.* worked by electricity), by steam-jets in factories, &c., or by *artificially heating* the air by specially-constructed furnaces which cause it to ascend a chimney or "outlet shaft" leading to the

open air, pure air taking its place by descending an "inlet-shaft,"—as in coal-mines. In both systems there must be *proper inlets and outlets* provided, especially in countries which have a temperate or a cold climate. The pure air comes in through the inlets, and the impure passes out by the outlets. But even with good ventilation, it is not always possible to get the air perfectly pure throughout the room, and then we must have enough pure air to *dilute* the impure atmosphere as much as possible.

We will first consider *Ventilation by Natural Methods*, as it is the one mostly in use, and Nurses should understand it thoroughly.

I. Quality.—The best inlet for *pure air* into a room is the same for the sick or the healthy and the poor or the wealthy. It is the open window. One can readily understand that the air which enters by it *must come from a pure source*, that is to say the atmosphere outside the house must not be a contaminated one. It must not be polluted by effluvia from bad drains and unhealthy surroundings. Nurses will understand how essential it is that streets without, and buildings within, should be kept clean.

1. To ventilate a room by the open window (of the ordinary pattern) the *upper* sash is pulled down. The extent to which it is opened depends on the amount of air required by each person in the room. The air comes in from two places: from the top of

the upper sash and from between the two sashes. If the lower sash were raised, and the upper not pulled down, the in-coming air would blow on and chill people near the window, or those sitting in the current of air. Cold air, being heavy, descends to the floor, and then passes along the carpet to the fireplace, especially if there is a fire burning, and then ascends the chimney. It therefore chills the feet. When the upper sash is lowered, and also when the air enters between the two sashes, it comes in at a higher level, and is directed by the upper end of the lower sash *towards the ceiling*. It therefore does not blow on one, but passes overhead, and before descending mixes with the warmer air in the room which it purifies, and is then inhaled. It consequently causes no chill, especially if the room is properly warmed.

The patient's bed ought not to be in a direct line between the open window and the fireplace, as he will then be in a draught. The bed should be placed somewhat to one side, but not in a corner, nor in contact with the wall. It should be at least one foot from it, and one ought to be able to walk all round it. Bedclothes and wearing-apparel rubbing against the wall or touching the floor dislodge and collect germs and dust, which may be infective.

It is unnecessary to open the sashes above and below. In warm weather the windows can be freely

opened. Sometimes the upper sash is a fixture; this is a great defect. The Law enforces that all "living-rooms" must have a window opening directly into the external air, that *one-half* of it at least must be capable of being opened, and that the opening must extend in every case to the top of the window. Each "living-room" must also have a fireplace.

People object to open windows in a soot-laden

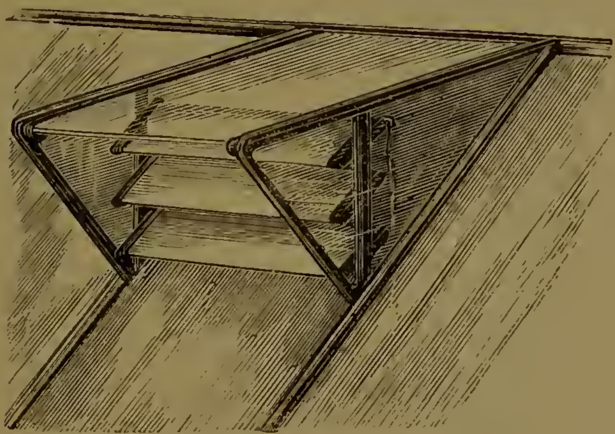


Fig. 1.—Hopper Ventilator for Skylights.

atmosphere. Fine muslin or curtain-net or wire-gauze stretched across the openings will keep out the particles; or pieces of perforated zinc can be fitted. The air current is thus diffused and draughts are minimised. The holes will need cleaning from time to time.

Rooms with "French" or casement windows (which open outwards like doors) are not easy to ventilate. A sheet stretched across the half-open

window, or curtains, will be useful, and will prevent a draught.

In the "attics," builders make a window or

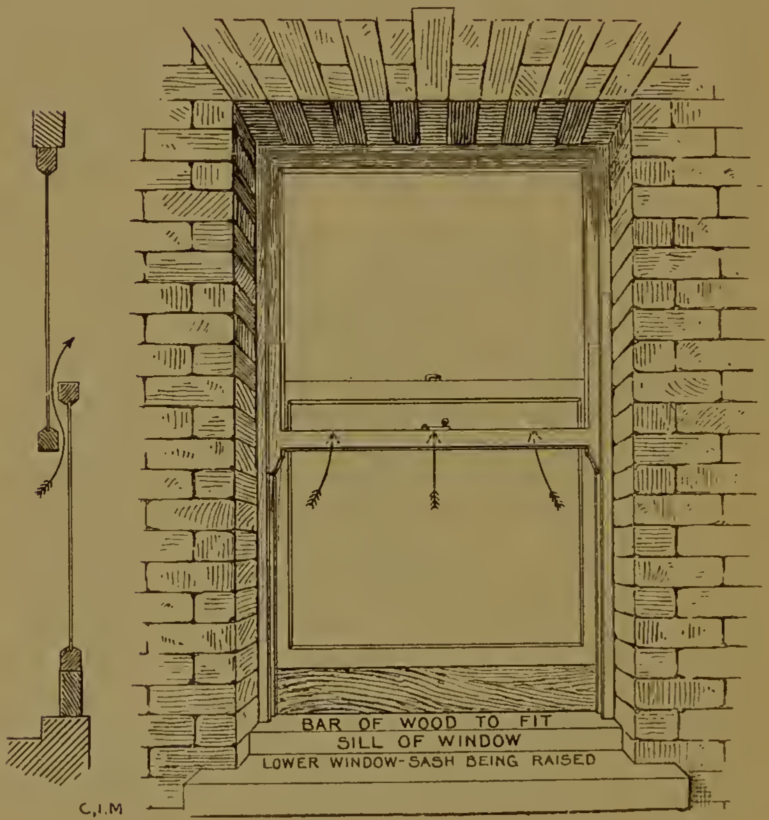


FIG. 2.—Hinckes-Bird's Method.

skylight in the roof so as to evade the Law. This is an evil, because in rainy and cold weather it is invariably kept closed, and in fact is seldom opened. The hopper ventilator for skylights is useful and

keeps out the rain (Fig. 1). Where no such ventilator is supplied, but one of the ordinary kind is fixed, a waterproof sheet may be placed under the opening, and in windy weather a sheet across

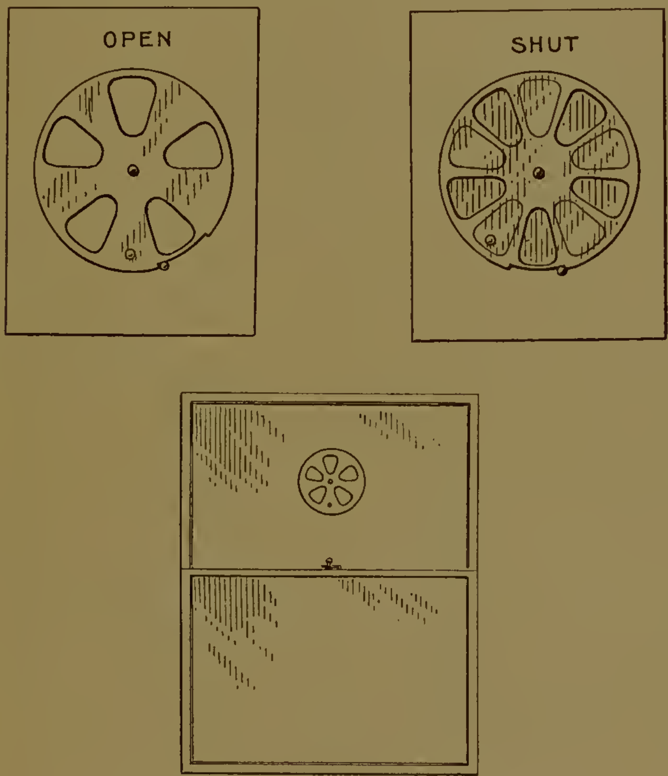


FIG. 3.—"Hit and Miss" Ventilator in Position.

the window will prevent a draught. Rooms so constructed should not be occupied as bedrooms.

2. In *Hinckes-Bird's method*, a bar of wood (a sand-bag will do also) is made to fit the lower part of the window-frame, and on it the lower sash

rests. Air is admitted between the two sashes in the middle of the window, and no draught enters below (Fig. 2).

Another plan is to have the lower part of the

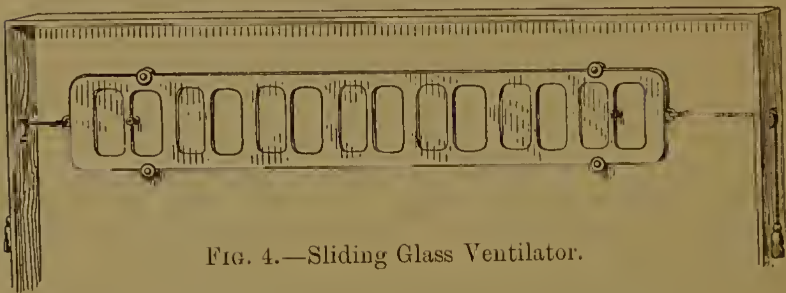


Fig. 4.—Sliding Glass Ventilator.

window-frame ("sill") built higher than usual (coming well up in front of the lower window-

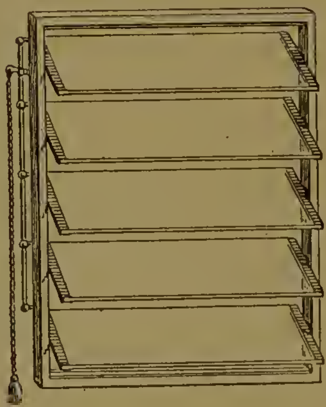


Fig. 5.—Glass Louvre Ventilator.

sash); air enters above between the two sashes when the lower is raised. This method is used in many of the London County Council Schools. Other methods of window ventilation are:—

3. Cooper's pattern of "*hit-and-miss*" discs of glass with holes in them, or by the "Sliding Glass Ventilator" (Figs. 3 and 4).

4. Glass *Louvre ventilators* (Fig. 5) which open like Venetian blinds, and the air comes in between them. "*Hopper*" ventilators open inwards and upwards towards the ceiling (Fig. 6).

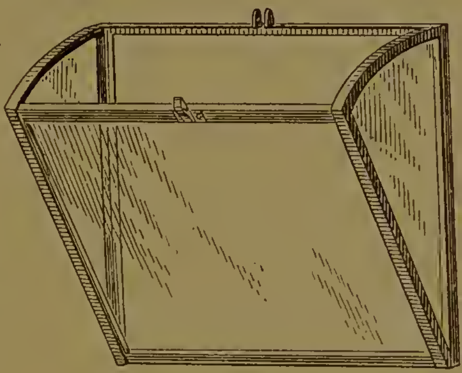


FIG. 6.—Hopper Ventilator.

5. The *Sherringham valve* is one which is pulled open, and the air passes inwards and upwards (Fig. 7).

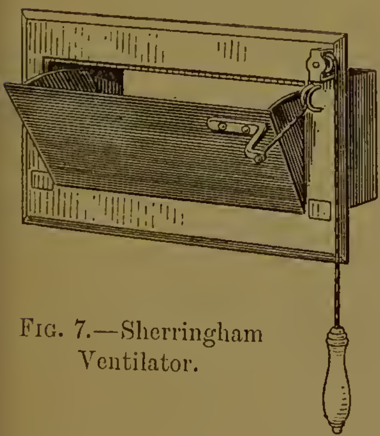
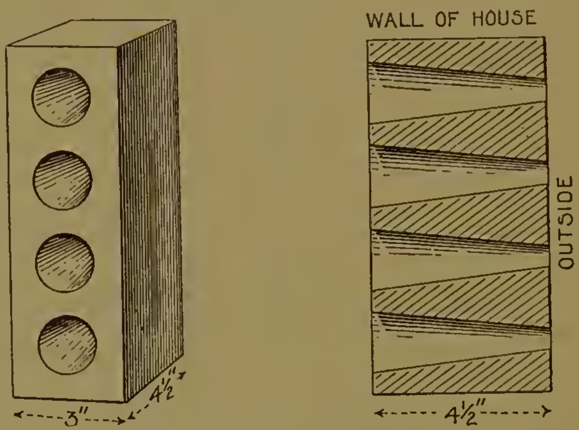


FIG. 7.—Sherringham Ventilator.

6. Another method of ventilating a room is to have openings in the cornices; air blows in at one side and escapes at the other.

7. *Perforated bricks* are inserted in the wall, the holes being conical (like an ear-speculum), the *larger* opening being *inside* the room and the *smaller* one *outside*. This prevents a draught by diffusing the in-coming current (Fig. 8).

8. *Tobin's tubes* of metal (round or oval in shape) are placed in the corners of a room; air enters them by an opening through the wall at the foot, ascends the pipe and so passes into the apartment. They are provided with a valve for increasing, diminishing, or shutting-off the supply of air as required, and are smooth inside and without angles so as to prevent dust from accumulating.



Perforated Brick (Inner Side).

Section of Perforated Brick.

Fig. 8.

Most of these are not found in small houses.

How high should air-inlets be placed? On an average (in a system of Natural Ventilation) about 7 or 8 ft. above the floor, so that a person standing or sitting will not be too far from the in-coming fresh air, and yet not be in a draught.

Openings for ventilation are also made through the ceiling and roof.

9. *Mackinnell's ventilator* is of this description. It consists of two vertical and circular pipes, one inside the other, with a space between. The *fresh air comes down through the outer* and shorter tube, and is distributed over the room by a flange, and the *impure air passes out by the inner* and longer pipe, at the top of which it is advisable to have a movable or rotating cowl, which creates an upward current and prevents rain coming in (Fig. 9).

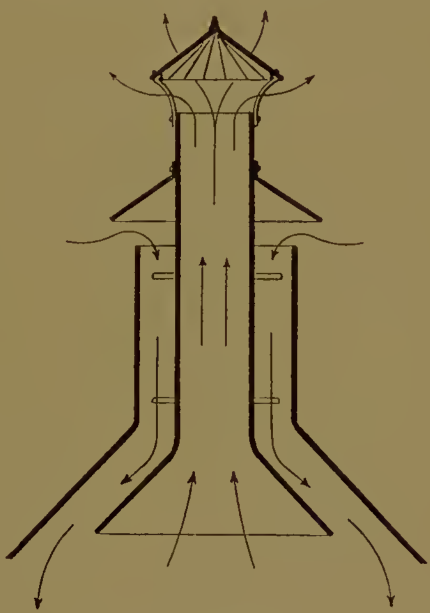


FIG. 9.—Mackinnell's Ventilator.

At all seasons of the year fresh air must be obtained from the outside atmosphere, and not from an adjoining room, landing, &c. To open the bedroom door for ventilation will not do, *because the air has already been contaminated in another part of the house*, and is therefore unfit for breathing again. It is best to consider that windows are made for admitting *air and light* into a room, and that doors are only for *persons* to come in and go out.

For air to enter near or through the floor (as in churches where there are hot-air apertures in the aisle) is not hygienic, as it carries up with it dust and germs, which are inhaled.

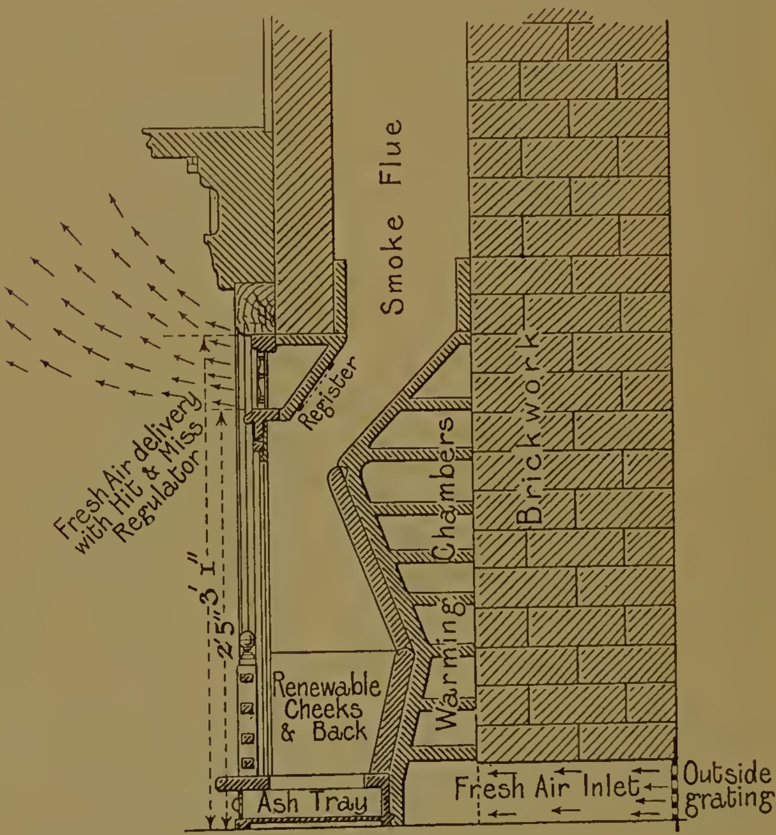


Fig. 10.—Galton's Method.

10. In *Galton's Stove* fresh air enters through the wall to the back of the stove, ascends by a *separate* pipe and passes in free from smoke, &c., near the mantelpiece, so that it is pure and warm.

This method combines Ventilation and Heating (Fig. 10).

II. Quantity.—*How much pure air is required for the Healthy and for the Sick?* It depends to a certain extent on the age of the individual, and whether he is in a state of rest or of active exercise; and above all things if he is healthy or not. Children do not require so much air as grown-up people.

"Cubic feet" express quantity in volume. An *empty* room 12 ft. long, 9 ft. broad, and 10 ft. high will contain $12 \times 9 \times 10$, or 1080 volumes of air expressed in cubic feet. If it contains furniture and boxes, there will be less empty space for air, and consequently its air-capacity will be less than 1080 cubic feet. In all calculations for ventilation and air-supply, the space occupied by such articles must be subtracted from the total amount of air the room would contain were it quite empty. "Linear" inches or feet express length or distance *in a straight line,* so that to say "the air enters a room at a velocity of 2 (linear) ft. per second," means that in one second of time the air has travelled a distance of 2 feet (or 24 inches). In health, about one-thousand five-hundred cubic feet of pure air *per hour* for a child, two-thousand five-hundred for a woman, and three thousand for a man are sufficient. The supply must be a *continuous* one. Three thousand cubic feet for all adults may be taken as a good average. In sickness the amount should be greater in each case,

especially in such dangerous infective diseases as Small-pox, Typhus fever, and Puerperal fever, and after serious surgical operations. In such conditions four thousand cubic feet per adult would be advantageous if they can be obtained.

III. Continuous Supply.—Pure air must be continually coming in night and day and at all seasons of the year, the room being properly warmed.

IV. Velocity.—How fast should the air enter the room? In other words, "What should its velocity be?" If it comes in too rapidly and is not suitably warmed, it will certainly cause a draught, and may chill those near the inlet. Therefore, one must consider *velocity*, *temperature*, and the *size of the aperture* through which the air enters. An average room-temperature for winter and summer should be about 60° Fahrenheit, and the velocity, or rate of inflow, should be from $1\frac{1}{2}$ to $2\frac{1}{2}$ linear feet (18 to 30 in.) per second.

The whole atmosphere of a room should be changed three times in one hour, so that if 3000 cub. ft. are admitted in that time, then 1000 cub. ft. enter every twenty minutes. A window sash, 1 yard wide and opened only 4 in., will allow 5400 volumes (cub. ft.) of air to enter the room in one hour, if the current flows in at a velocity of 18 inches per second. This will practically be enough for two adults. If the sash is pulled down 2 in., flowing at the same velocity, nearly 3000 volumes per

hour will enter—quite sufficient for one individual. Some air will also come in between the sashes. Unfortunately, owing to the rooms and windows being small, we can in many cases get only 1000 cub. ft., and even less, per hour.

In lodging-houses for poor people, not less than 300 cub. ft. per hour for each adult is allowed by Law, and for children under ten years of age, half this amount. In some cases it is advisable to have the air cool, as in the treatment for Tuberculosis, and Nurses know that the open-air treatment for that disease is to have the patient out-of-doors even in freezing weather; or to have the window of the room wide open always, keeping the body quite warm with clothing and blankets—the cold air diminishes the chances of hæmorrhage, and being pure, it tends to prevent the activity of the germs of Tubercle in the lung.

V. Temperature.—The temperature of the room is usually taken by an ordinary (not a Clinical) Thermometer, which does not register. It must not be placed near the fireplace or the open window where there are extremes of heat and cold; it is used to ascertain the average temperature of the air in the apartment. It should be taken in one or two different parts of the room, so as to get a fair idea of its general warmth, which should be about 60° F.

VI. Impure Air.—We have next to consider the *removal of impure air* by suitable outlets.

The air of a room, as we know, is rendered impure by gases, vapours, and exhalations from individuals, and also from slops, drains, &c., which may cause an unpleasant odour. Particles of dust, hair, and *skin*, may be visible to the naked eye, *germs of disease* can only be seen under the microscope. These accumulate, especially on the *walls and floor* of a room, and also on curtains, furniture, &c.

Gases and vapours are given off in the breath of people and animals in the room, and also by coal-fires, gas-stoves, lamps, and candles. The germs of disease from patients infect the atmosphere of the sick-room, and may be carried about to other parts of the house, and in this way spread diseases. People do not seem to understand how unhealthy it is to inhale their own breath or that of other persons, even if they are not ill. In the first place, respiring air so contaminated lowers the health, reduces one's resistance against infection, and in consequence renders a person far more liable to be attacked by disease. In the second place, if people are already ill, their disease will probably be of a severer type; or their convalescence be more protracted, if the sick-room is badly ventilated. The Nurse attending the case will be more liable to take the disease owing to a lowering of her own state of health. All will appreciate, therefore, the importance of the matter to themselves personally, and will see why efficient ventilation is a means of pre-

venting infection. It also diminishes the chances of a fatal termination to a bad case. Children's faces should not be covered with the bed-clothes or with "a head flannel" as is often done. If the face is protected at all, only such material must be used as will allow the air to pass in and out easily, *e.g.* "net veiling."

The simplest method of removing impure air in dwelling-houses is by the ordinary open fireplace. As we know, the hot air, gases, and smoke from the fire pass up the flue, and, in doing so, carry with them the vitiated air of the apartment. An open fireplace is therefore an excellent ventilator. This is why in Hospital wards they are in frequent use; the flue in many cases passes under the floor and then to the outer air. Especially "*open* fire places," because "closed stoves" (although they heat more, use less coal and are therefore more economical) do not "draw" so much air, and are not good ventilators.

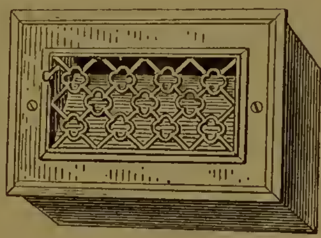


FIG. 11.—Outlet Ventilator (for the Escape of Impure Air into a Flue or other Channel).

Other outlets are in the form of talc or mica "flap-valves," which open only in one direction, and direct the impure air preferably into the chimney (Fig. 11). Air is drawn into the flue and no smoke can go back into the room, as the valves close like

a mouse-trap. Both mica and light metal valves make an unpleasant clicking noise, and it is preferable to have the "flaps" made of oiled silk (such as "green protective"), which overcomes this difficulty and is easily replaced.

Higher up in the walls of large rooms there are outlets for the escape of impure air, about 10 to 13 ft. above the floor, where the warmer and vitiated air collects and passes to the air outside through similar valves.

Other ventilators for the escape of air are Cowls, which may be "fixed" or "moveable." They all should have a "hood" to prevent wind and rain from entering them. Moveable ones are of various shapes. Some are continually turning round ("rotating cowls") by the action of the wind, and others of the "lobster pattern" (because the plates are bent and overlap) turn with their backs to the wind, to prevent draught or rain going down the chimney. In these the impure air is drawn out of the building by the Aspirating power of the wind.

Boyle's ventilator acts similarly, and is placed on the roof of large rooms or halls (Fig. 12).

In all methods of ventilation, whether Natural or Artificial, there are several important matters to consider. These are: the size of the inlets and the size of the outlets, their *number*, *their positions in the room*, and their *situations with respect to each other*. In

Natural Ventilation, and for a healthy person, the opening by which air comes in ought to measure at least 24 square inches. That means it may be 12 in. long and 2 in. wide, or it may be 6 in. by 4 in., so that the size of the opening is 24 sq. in. for each adult person. The corresponding outlet should be of the same size.

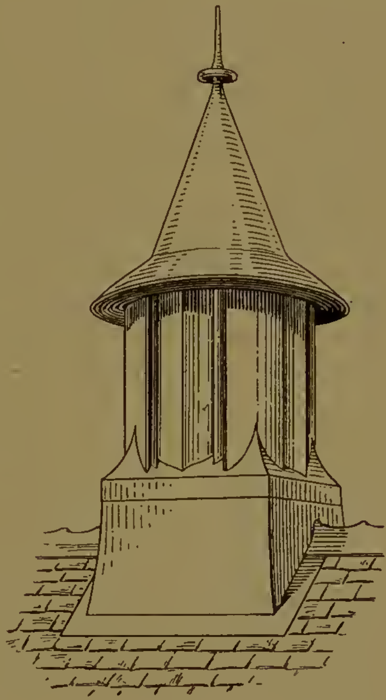


Fig. 12.—Boyle's Ventilator.

The cold air may come in at the rate of about $1\frac{1}{2}$ foot per second. Its velocity may be $2\frac{1}{2}$ ft. per second *if the air is warm.*

How many openings should there be?

If it is a large apartment, one opening will not do. In that case it is far better to have many small inlets and outlets scattered all over the room. If there is only one big opening, large enough to allow sufficient air to enter for everybody, the result will be that the people near the inlet will have too much air, and will also be in a draught, and those at a distance from the inlet will certainly experience no draught,

but will not have a sufficient supply of pure air. They will be breathing a volume of air which will become more and more impure. Therefore, to prevent this, it is necessary to have the inlets all round the room. If there are numerous suitably-placed openings, though each one is small in size, there will be proper ventilation and no draught; whereas, if we have only one large opening, there will be a great draught through it and inefficient distribution of air all over the room. The openings, however, in a narrow chamber should not be immediately opposite each other. The *position of the outlet depends greatly upon the position of the inlet,* and *vice versâ.* If the openings are opposite one another, and particularly if they are high up, the wind blows in and passes out again far above the heads of the people, and they will get no fresh air, because the pure air will enter in at one and escape at the other side. In a Church or Cathedral the windows, if at a great height, are of no use whatever for ventilation. The congregation below will be in a "well" of bad air.

Therefore for Natural Ventilation the openings must be sufficiently low down.

In a room the inlets for pure air should be about 6 or 7 ft. high, so that people either standing, sitting, or lying down will be supplied without discomfort. About 14 ft. is the *highest level at which outlets* should be placed *for ventilation by Natural methods.*

Let us consider why it is so. When people breathe, the warm air ascends, but it rises to a certain height only. If the room in a house has its outlets too high up, the bad air rises about 14 ft. or so, and does not escape, but meets a layer of colder air at the top and gets cold itself. Cold air is heavy and descends, and so the people keep re-breathing the contaminated air because it never reaches the outlets. A high ceiling or a high roof (as in Cathedrals) will in itself be no help to good ventilation. The outlets and inlets must be properly placed. When people in a room have all the windows shut, it favours the spread of infection.

We realize that good ventilation will remove that danger, especially in the case of "Consumption," which is a disease spread by germs through the air. In railway-carriages people travel to places for the sake of their health; perhaps they are suffering from lung-disease, and they insist on having all the windows closed. The germs, then, which are exhaled are inhaled by other people in the carriage, and thus the disease is spread. How important it is to have pure air!

When attending Infectious cases, it is safest to keep as much as possible on the *windward side of the patient*—that is, on the side of the open window, so that in-coming air passes *from Nurse to patient;* and if, on entering the apartment, the air feels "stuffy," we must make sure that the window is

open, taking all precautions to avoid causing a chill. One should not sit in the direct line of the current of air passing from the infectious patient to the fire-place, but to one side of it. Typhus fever (a disease, fortunately, rarely met with) is very contagious, especially in the immediate neighbourhood of the patient. All should avoid as much as possible inhaling the breath, and emanations from the skin, excreta, &c., in every case of infectious disease. No food or drink must be taken in the sick-room by the attendants.

To test the direction of the air-currents in a room, a piece of smouldering brown paper or velveteen is held near the window, at its upper and lower openings, and at the key-hole, top and bottom of the door, and near any openings where a draught is felt. The direction taken by the smoke is to be noted. The flame of a candle will also do, but one must beware of setting fire to curtains, &c. A fine current of air blowing on a moistened finger is easily felt by most people.

A badly ventilated room is detected at once by a person *coming into it from the open air.* The stuffy sensation is most unpleasant. This is a simple and a useful *practical test.*

Every room should be ventilated by widely opening the window for an hour or two daily, and every empty room ought to be "aired" before it is occupied.

The ventilation of villages and Towns is also important, and this is attained by having large open areas, such as parks and squares (often called "the lungs of a city"), wide streets, and buildings not too close together, It is for this reason that "*back-to-back*" houses are prohibited. In them sunlight and ventilation are deficient and over-crowding prevails.

II. Artificial Ventilation

When the ordinary methods of ventilation are inefficient, air is supplied by *causing it to move into or out of a building by artificial means.* In large establishments containing many rooms, it is impossible to produce a continuous current of air unless it be forced along. This is done by two methods, which are known as the Plenum and Vacuum respectively.

The Plenum Method (from *plenum*, full): pure air from outside is forced into the building by special machinery, such as rotating fans.

In the Vacuum Method the impure air inside is removed from the building by driving or drawing it out. This can be done in two ways: (1) By machinery, or (2) by heat.

Rotating fans can be worked by electricity or by steam. They may be used for either of the above methods, as the air can be driven into, or out of, a building by them. The quantity of air so set in motion can be exactly calculated, and its velocity

regulated. It may also be warmed or cooled before entering the rooms by using special apparatus, such as a cold-water spray or a heat-radiator.

In the Plenum Method the air *must come from a pure source.* It can be strained through layers of cotton-wool, jute, or canvas, to remove dust, &c., if necessary. It is distributed all over the building by special pipes and inlets, and this is a great advantage in large Hospitals, &c., where there are many patients. Each patient has a fresh-air inlet in the wall close to his bed (preferably at the head of the bed), and it can be turned on or off as required. The temperature of the in-coming air is regulated in summer and winter. In some Hospitals the inlets are higher up in the walls and supply the entire ward. In all cases the control of these inlets must not be in the hands of the patients, but is to be regulated by the Staff.

In the Vacuum Method the revolving fans draw air out instead of forcing it in; and this removal of impure air can also be effected by specially constructed fire-places and furnaces which produce a draught up a high chimney or "shaft." This is done in coal-mines and in large factories, and both methods may be combined, as in the House of Commons.

The simplest example of extracting impure air by heat is the ordinary fire-place in a room, which we have already considered. It requires no special

apparatus. Galton's stove (already referred to) is another example. In many Hospitals the large open fire-place in every ward has a ventilating flue passing under the floor to the outside air, and is an efficient ventilator (Fig. 13.)

One *objection* to forcing air out of a room is that

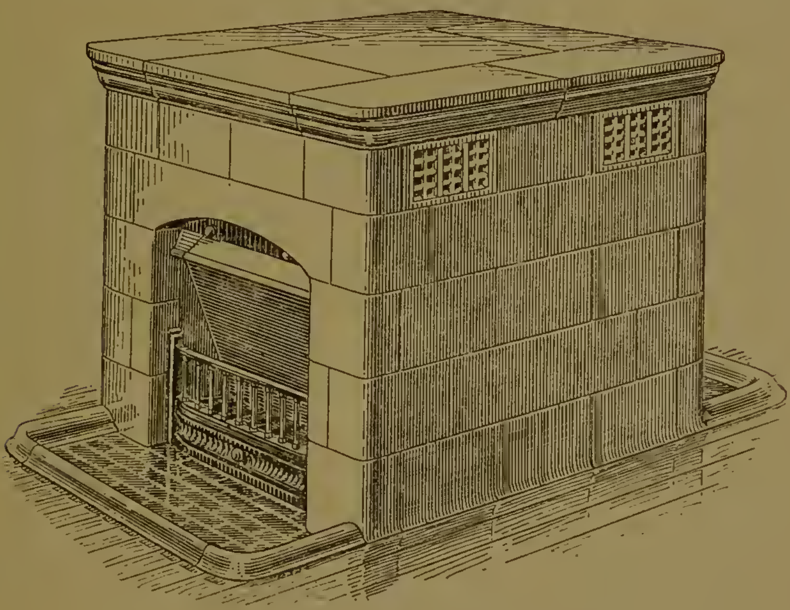


Fig. 13.—Two-fire Stove with descending smoke flues.

the air which rushes in from *all available inlets* (to take its place) may be very impure. We cannot be sure where it will come from—it may, for example, be drawn from drains, contaminated soil, or other unhealthy places outside the building.

Impure air may also be removed by ordinary gas-burners placed at the upper part of a room or

near the ceiling, These lamps are fitted with a double flue-pipe and the gas-jets are arranged round the base of it. The hot air rises as the gas burns, and of course mixes with the impure air, which is always to be found at the top of a room or building, and the two pass together up the inner and outer pipes and out to the open air. The electric light has superseded these.

The drawbacks of Artificial Ventilation are its great expense, and the risk that the apparatus may fail unexpectedly and leave us without any ventilation. On the other hand, Natural Ventilation may be ineffective when there is no air in motion (as in foggy weather); or when (because the outside air is too cold and the room is not properly heated) people will shut every inlet and outlet, even including "the register" in the fire-place. It is necessary that this be always kept open. In Natural Ventilation it is essential that the incoming air pass from below upwards and finally outwards through this open "register," unless special outlets are provided.

In the PLENUM METHOD, when the warmth and direction of the propelled air can be carefully regulated, it may come in through inlets at the *upper part of the room*, then pass *downwards*, and finally be *drawn off near the floor by special outlet-pipes.* Contaminated air can be disinfected before it is allowed to escape into the atmosphere outside. This may be effected in two ways: (1) By causing

the infected air to pass through screens containing a disinfecting lotion; (2) by passing it through the fire of a furnace, which will destroy all germs. This purification of the out-going air is a great advantage in cases of Infectious Disease and is used at the Birmingham Hospital.

CHAPTER III

HEATING AND LIGHTING

THESE two practically go together. The room must be properly warmed, and the *simplest* way of combining this with ventilation is by having an open fireplace, but this is not always a satisfactory method. First, however, we must consider what is the proper temperature of a room in health or in sickness. 60° F. is a very good average, though in hot weather it may be desirable to have the room much cooler. The temperature may be between 55° F. and 70° F., but never above 70° F. In some cases it is advisable to have a low temperature, because cold air like cold water diminishes the liability to hæmorrhage, as in cases of lung-disease.

Very young people cannot stand a chill. Cold air being breathed becomes warmed in the lungs, but cold air flowing upon bare arms and legs is the very thing to cause a chill ending in a serious illness. One of the most common diseases among children is Acute Rheumatism, and it is brought on by exposure to cold. Rheumatism in the child

does not clinically resemble the same disease in the adult. In the latter it is the joints that are painful, but in the former usually the muscles. This is wrongly termed "growing pains." In many cases these mean Acute Rheumatism, and, as we know, this disease often affects the heart. In nearly all cases of cardiac trouble the patient has had Rheumatic Fever, and that may cause death, or an injury for life.

Very old people are also prone to take a chill, and this often ends in that disease which kills most adults—Pneumonia. An individual weakened by cold is less able to resist infection, and if the germs of this disease obtain access to his lungs he will probably be attacked, for we know Pneumonia to be an infectious Fever.

Heating

Heat is distributed in Nature in three ways: by (1) Radiation; (2) Conduction; (3) Convection. The sun is our great centre of radiant heat, and it is given off by every warm body. Rays of invisible heat travel through the air and are absorbed by solid bodies, such as our skin, the walls and furniture of a room.

Radiant heat warms the air very slowly, and does so by raising the temperature of the water-vapour (moisture) contained in the atmosphere.

Air absolutely free from moisture is not warmed by radiant heat. Water, as we know, absorbs heat slowly, and that is why the air of a room takes a long time to get warm after a fire has been lighted. The amount of heat received is greatly lessened by distance: a person two yards from a fire gets only one-fourth of the heat obtained by a person one yard away from it, and another three yards distant receives only one-ninth of the warmth.

Heat by CONDUCTION travels from particle to particle, when these are in contact with one another. That is how a poker or a stone-ware or rubber hot-water bottle is heated. Some substances are good conductors of heat—such are metals; others are bad ones, such as glass, stoneware, wood, and wool. Along these heat travels slowly. It is for this reason that a metal rod soon gets too hot to be held, while a match is only slightly warm beyond the burning-point. Woollen materials *being bad conductors* keep our bodies warm, because the heat is not allowed to escape rapidly through their particles into the air. Cotton is a better conductor of heat and therefore is cooler for wear than wool, and when wet is more liable to cause a chill.

Heat by CONVECTION is distributed by the *moving particles of a liquid or a gas* which have been warmed. This happens when water boils and when air is heated. The warmer and lighter particles ascend

and are replaced below by cooler ones, and this goes on till the entire volume is of uniform temperature.

The air of a room in which a fire burns is heated chiefly by CONVECTION, after having been in contact with the walls, grate, furniture, &c., which have themselves been warmed by RADIATION and CONDUCTION from the burning coal.

The following are the essential points of a good open fireplace of modern construction. The old patterns should be condemned, they are wasteful of coal and do not heat an apartment efficiently.

1. The back and sides of the grate must be constructed of fire-brick. This retains heat well and so warms the room.

2. As little metal as possible must be used. It conducts the heat away and cools quickly. In place of iron, firebrick is to be used in the grate itself, and outside it ornamental tiles are efficient.

3. The back of the grate ought to *lean forward* over the fire. In this way heat is reflected into the room.

4. The bottom of the grate should be near the hearth or even directly on it. It should be a solid block of stone without holes; or there may be small apertures for the ashes to fall through. This prevents too rapid a draught through the fire from below upwards, which would cause too rapid combustion and waste. A shield or "Economiser" may

be used to close the space between the fire and the hearth, and so save the coal.

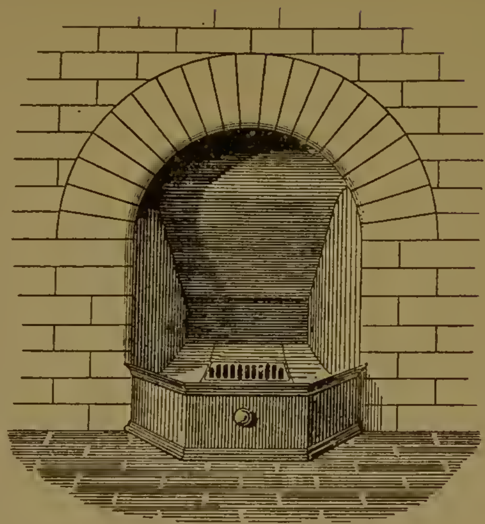
5. The spaces between the fire-bars must be *narrow and vertical* to prevent draught. In modern fire-places there are *no bars at all*, the space being open.

6. The "throat" of the flue (just above the fire) should be narrowed and so constructed as to prevent too rapid a draught, &c., up the chimney.

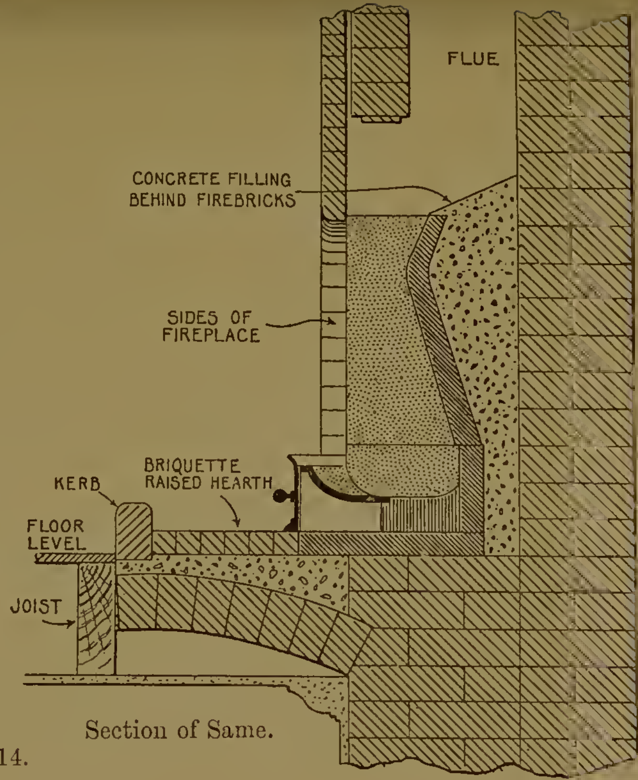
No woodwork must be nearer than 1 ft. from the back of the fire-place.

The "Devon grate" is one of several good modern patterns. In most there are no fire-bars at all; the grate is very low, and it is absolutely open. Fresh coals are put on *in front of* those which are half burnt-out, and *not upon them*; the latter are pushed back to make room. The fire, therefore, creeps forwards to ignite the new supply, and the heat is well in front of the grate, does not escape up the flue to be wasted to such an extent as in the old patterns, but is thrown *forward into the room*. There being no unnecessary draught, the coals burn slowly and last a long time. All parts of the grate (which is chiefly of fire-brick) are readily removable, and it can be easily cleaned, and ashes, &c., extracted from below the fire. These grates will burn for hours with little attention, and will warm efficiently.

"Closed stoves" may burn coal or gas, and they



The "Devon Fireplace" and Grate without Fire-bars.



Section of Same.

Fig. 14.

are surrounded by metal, which is a disadvantage. They may become red-hot, and are then dangerous not only from the chances of setting things on fire, but also because Carbon monoxide, that very deadly gas which is produced when coals or coal gas are burnt, can readily pass through red-hot iron or copper and enter the room. When gas is used it may leak into the apartment from any faulty joint. It is therefore most important that the ventilation be good, and that a proper flue be provided. "Closed stoves" often cause an unpleasant feeling of dryness of the skin and throat when the room becomes over-heated. This is due to the peculiar property which hot air has of absorbing moisture from every available source. It is *not because the air is dry*, but because it has the property of rapidly taking up the water-vapour which evaporates from the skin, as perspiration, and the moisture also from the mouth and throat of those in the room; and in consequence they feel most uncomfortable. This can be remedied by placing a basin of water near the fire, the vapour from which takes the place of that drawn from the body.

Improvements have been made in gas-fires; and when they are well fitted-up they are useful and convenient. To light them, one has to be careful to have the match already ignited, and to hold it just over the row of burners before turning on the gas. Should this be allowed to escape, and to mix with

the air in the grate before applying a light, an explosion will occur. Their disadvantages are: escape of gas, over-heating, and discoloration of the ceiling, &c.

Oil-stoves may be used for heating a small room. They must be placed near the flue to allow of the escape of all fumes into the open air. If filled with any "mineral oil," especially petroleum, they are very dangerous, as the oil is most inflammable and gives off an explosive vapour which will easily take fire. The smell is also disagreeable.

Special gas-stoves consisting of two chambers, one within the other, are made. The inner one is heated by gas-jets placed below it, and contains fresh air which enters by a pipe through the wall. This heated air next passes into the apartment unmixed with the fumes of combustion, which escape out of the room by a separate flue up the chimney, and so do not contaminate the atmosphere of the apartment.

Hot-air and hot-water pipes ("radiators"), steam, and electricity are also used, but these are outside our purpose, and are suitable only for large rooms and Hospitals provided with special apparatus.

Lighting

Light is of great importance in Hygiene, especially sunlight. In the account of the Creation it is

stated that the first thing established was "light." We know that light has a beneficial effect on the human body because it conduces to growth, and where there is plenty of sunlight in a house there is probably good ventilation also. Another important point is that sunlight destroys germs. The following experiment will prove this. A glass box containing growing germs has its lid partially covered with black paper, so that sunlight can only reach the germs in uncovered places. It will be found after a few hours' exposure that where the rays have fallen on them the germs are dead, but those protected by the black paper are living and growing. The bright sunlight in summer kills germs much more quickly than in winter, when the rays are not so powerful. Sunlight also has a good effect on the body generally; it stimulates growth by its action on the protoplasm, and by causing more rapid vital and chemical changes. One will understand that in consequence it favours healthy development. There are two varieties of sunlight—direct and reflected. The owners of rooms beneath the level of the ground, where but little light can enter, have to resort to reflecting surfaces. These may be of glass or metal, and prisms of glass are most useful. Often, too, in shops the backs of which are dark, one sees a mirror placed at an angle in the window. The sunlight is reflected in this way into the room. White paper also reflects light, and in

a sick-room it is much better to have a light-coloured paper than one of a dark pattern, which not only prevents the room from looking cheerful, but also lessens the light in it, because dark-coloured materials absorb both light and heat.

In our Northern latitude the sun is always South at noon, and therefore to obtain most sunlight all the year round (as Artists are aware) a room should have a "Southern aspect." A good rule for the size of the total surface of glass for *lighting* a room properly is that it should be one-tenth the size of the floor area. For example, if the floor of a room is 300 square feet (*i.e.* 20 ft. by 15 ft.), the area of glass ought to be 30 sq. ft. in size (*i.e.* 6 ft. by 5 ft. for one window, or, having two windows, each of 3 ft. by 5 ft.). The same rule would apply for calculating the amount of open-window space in a room.

Artificial Lighting

This is by gas, oil-lamps, candles, and the electric light. All these, except the last named, render the air very impure by combustion. An ordinary gas-burner lighted for one hour vitiates the air of a room as much as five adults will in that time. Ventilation must therefore be specially attended to in all these cases, and all fumes must be allowed to escape into the open air, preferably up the chimney.

Lamps burning "low-flash" (easily inflammable) oil are, as in the case of stoves, to be specially avoided.

The electric-lamp needs no allowance for ventilation, because it is entirely enclosed in a glass bulb from which air has been removed. It gives off no fumes, does not cover the walls with soot as coal- and gas-fires do, and does not contaminate the air. Properly shaded, it is the *best light for the sick-room*; the direct glow is harmful to the eyes, and is liable to cause irritation, headache, and inflammation. The bulbs for reading-lamps should be of "ground glass," or may be covered with fine silk to give a subdued light.

CHAPTER IV

WATER—GENERAL SOURCES OF SUPPLY

WATER is one of the necessities of Life. Without it both the animal and the vegetable world would cease to exist. Let us briefly consider some of its properties which influence very greatly our daily life. Water freezes at 32° Fahrenheit (or 0° Centigrade) and boils at 212° F. (100° C.). At 39·2° F. (4° C.) it contracts to the smallest space it can occupy, that is to say, it is then most concentrated in volume, and is at its greatest density and weight. It has the peculiar property of *expanding when cooled from* 39·2° *F. to* 32° *F.* (when it forms ice), and it also becomes *lighter*. This explains two things: (1) why water-pipes burst in frosty weather, because the expanding ice forces them open, and (2) why ice floats, because it is lighter than water. On being heated from 39·2° upwards to its boiling-point, when it becomes steam, water also expands and becomes lighter. It gives off moisture (evaporates) at all temperatures, and we know that in doing so it cools the wetted surface. We make use of this property in applying wet cloths or evaporating-

D

lotions to reduce heat and inflammation or pain, and we know the risk one runs of being chilled by wearing wet clothing (particularly linen and cotton) next the skin.

Water has other remarkable qualities: it has a perfectly flat surface when at rest, like all liquids. It practically cannot be compressed, that is to say, it cannot be forced into a smaller space by pressure. If it is contained in a closed vessel such as a rubber bag, pressure applied at any part of the bag will be equally transmitted in every direction by the water. That is why water-mattresses and water-pillows are used when we want the body to be *equally supported*, so as to prevent undue pressure on any part, as in cases of spinal disease, bed-sores, &c.

Water takes a long time to get heated, and cools slowly.

For the latter reason it is useful for fomentations and for filling hot-water bottles, because the heat is long retained if evaporation be prevented. If kept in tin cans it cools much more quickly, because metal "robs" it of its warmth, being, as we know, a good conductor of heat, which water itself is not.

For drinking and cleansing purposes, pure water is essential to health. Impure water causes many diseases, and rapidly spreads infection if it contains germs. Many dangerous bacteria such as those of Typhoid fever live and grow in water for some time. We shall refer to these later.

What are the characters of a pure water suitable for drinking? They can be estimated by the naked eye, by the sense of smell, by taste, and (more scientifically) by chemical and microscopical tests. By employing the simplest methods one is able to form a very fair opinion of the water being suitable or not for drinking.

1. **By Sight.**—(*a*) The water must be *colourless* when viewed in small quantity. A simple way is to fill a long test-tube with the water, and to look vertically downwards through the sample, having a piece of white paper or a white tile under the tube. No colour ought to be detected. Large volumes of clean water, seen in reservoirs or swimming-baths, have a greenish or greyish appearance. Vegetable matter will also cause a green coloration. A brown colour may be due to peat, iron-rust, or mud, all of which make it unpleasant to drink; it is also caused by dangerous pollution by fæcal matter, as from sewage. Colouring-matters may pass in from dye-works, and manufactories.

(*b*) *Clearness.*—There must be no turbidity or cloudiness, either from *dissolved* or from *floating* particles, On shaking it up, any sediment can be seen. Green particles may be vegetable; brownish ones mineral- or animal-matter. Small bubbles may be due to air dissolved in the water, as in deep springs, and are then harmless; but they may also be gas-bubbles given off by *decomposing animal*

or *vegetable* material, and then are indicative of danger.

(*e*) The "*Lustre*" or sparkle of a water should be bright and clear, but this is *not* a certain test of purity, because even polluted sources may yield a sparkling water. "All that glitters is not gold"!

2. **By Smell.**—This may be detected at once, and may alone be quite sufficient to condemn a sample. By heating slowly, short of boiling, any gases dissolved in the water will be given off and their odour will be, in most cases, readily apparent. Some persons, however, have a poor sense of smell.

3. **By Taste.**—This is not a certain sign of purity. In suspicious cases *it is safer not to taste the water*, which may be poisonous. Should there be much animal or vegetable matter *floating, but not dissolved* in the water, the taste will probably be unpleasant. If these impurities are completely *dissolved* the sample *may be quite tasteless*, and so the *danger may pass unnoticed*. A water may be rendered saline to the taste by flowing through layers of salt in the soil. This occurs in mineral springs, which may contain sulphate of magnesia ("Epsom salts") or ordinary "table-salt" (Sodium Chloride). It may also be due to sea-water or sea-spray obtaining access to reservoirs or streams of pure water. These causes would not render it dangerous for drinking. If not obtained from these sources, Sodium Chloride in a water indicates the presence of animal pollution,

possibly of urine, and then it is, of course, grossly contaminated.

4. **Chemically.**—Pure water is usually neutral in reaction. That is to say, it is neither "acid" nor "alkaline." This is easily tested by litmus-paper, with which all Nurses are familiar. If blue litmus-paper turns red when dipped in the sample, the water is acid; and if red litmus becomes blue, it shows the water is alkaline. In a neutral water no change occurs. A pure water may be very slightly alkaline. If this is so, it is boiled and tested again; should it still be alkaline, it is probable that it has been polluted by animal excreta.

A water may be slightly acid because it contains a dissolved gas (Carbon dioxide). It is treated as before by boiling, and tested again. If still acid, it probably contains some *added* acid, possibly one coming from the soil (peaty acids) or from factories, and is not suitable for drinking. A markedly alkaline water is the more likely of the two to be contaminated.

Chemical analysis is most important but cannot be explained here.

5. **Microscopically and Bacteriologically.**—If, when tested under the microscope, cotton or silk threads are found, the water is probably unfit for drinking. It is a bad sign to find in any water particles of clothing-material, or filaments of human hair, as these all point to human sources of contamination.

A bacteriological examination is made for detecting the kind of germs present, and their number.

The Sources of Water Supply

Let us next consider from what sources we can obtain water. It has been wittily remarked that our supplies are from "the Heavens above, the Earth beneath, and the Waters under the Earth." These include Rain-Water, Rivers, Springs, and Wells.

1. **Rain-water.**—This is usually pure and very soft, that is to say, it dissolves soap and makes a lather quickly. It is pure, *unless it has descended through a contaminated atmosphere,* such as that of a manufacturing town. In all cities dust of various kinds, gases, and fumes escape into the air in large quantities. The rain-water takes these up, *and gets polluted before it reaches the ground.* If already impure, it is rendered still more so as it flows into the nearest stream. Rain-water, if obtained from a clean source, and if kept untainted by being stored in a clean reservoir, is excellent for drinking and for washing. But if it is allowed to run off a dirty house-top (where birds and cats do collect), and into a water-butt without a cover, into which dust and dead leaves will fall, then it is rendered anything but pure, and is quite unsuitable for drinking purposes. This is, unfortunately, a common

method of obtaining and storing a supply of rain-water in cottages in the country where water is not laid on.

2. Upland Surface Water.—This is found in brooks and streams among the mountains or in rocky, uncultivated highlands where there are no people or animals to render the water impure. Brooks may be polluted, but when they are far from human habitations the water is pure. A spring or small stream near a village is often the spot where contamination may occur, and, in consequence, the water may be dangerous to drink.

3. Rivers.—The water from this source is nearly always badly polluted. Even in the upper reaches of a river,

> "Where every prospect pleases,
> And only Man is vile,"

the water, owing to human agency, is undrinkable.

Sewers empty themselves into it, and all manner of refuse from houses, manufactories, ships, &c., is thrown into a river. The Thames, for instance, resembles a huge sewer, and it is only after careful filtration and other treatment that its water can be drunk with safety.

4. Lakes, if of pure water, are excellent sources of supply. Every precaution has to be taken against contamination. Glasgow (from Loch Katrine), Manchester (from Lake Thirlmere), and Liverpool (from

Lake Vyrnwy) have large quantities of pure water carried in aqueducts from these distant sources.

Pools of "stagnant" (non-running) water, found sometimes in inhabited country districts and where animals drink, one need hardly say are greatly contaminated.

Next we have Underground waters, which may come to the surface *naturally* (as from a spring) or *artificially* (as by boring a well or by pumping).

Spring Water is usually good for drinking, especially if it comes from a great depth (a deep spring). It is generally somewhat "hard," and does not form a lather easily. Such waters may be warm; many have various salts dissolved in them, which are derived from the soil (Mineral Springs).

Wells are of two kinds, Superficial and Deep. A *Superficial well* is generally badly contaminated by impurities getting into the water at its mouth, and also by contaminated fluids trickling into it through the superficial layers of soil or entering through the side of the well. The water, not having much soil above it, is the more easily infected by dirt and filth being carried in, especially when the ground is sandy or gravelly, or has a stratum of chalk with fissures or cracks in it. Through these openings contaminated rain-water, road-washings, &c., and sewage from houses get access to the well-water. Nor can it be naturally filtered by the soil, because the depth is insufficient, and the soil itself is impure.

Taking, for example, the grounds of a farm-house in the country which has its water from a superficial well. The liquid refuse and slop-water from the house, the washings from the farmyard, from pigsties and stables can easily be conveyed to the well by trickling through the superficial stratum of soil, and also by being carried down by rain-water. A "cess-pool" may not be far away, and the brickwork of it and of the well may leak, so that fluid passes through, and contamination is certain. Whether the well-water be pumped or drawn by bucket, it is already in a dangerous condition, and is quite unfit for drinking or washing. In this way Typhoid fever and other infectious diseases are spread, and the source of the trouble may escape detection.

Deep-well water.—This is usually quite good, because it has *filtered through deep layers* of soil, and has had its impurities removed by them. Also, as it is well below the surface, it is not easily polluted. It may have percolated through the ground for miles before reaching its natural reservoir. Such wells are safest from contamination if they have a stratum of clay, forming an impervious (or waterproof) layer *above* the water and a similar layer *below* it. The fluid is then protected from impurities at both levels. These protecting strata are usually of clay, but they may be (particularly the deeper one) of hard rock. Large volumes of water

are usually present in such formations, as there can be no evaporation. The pressure under which these accumulate is so great that a boring sunk down to the water level produces a forcible rush of water of excellent quality, an artificial spring being formed. Such borings are known as "Artesian Wells," because the first one was effected long ago at Artois (in France). Much water of pure quality is found in chalky soil, as near Dover and the S.E. Coast of England. It is usually very "hard," from the lime salts of which chalk is composed (Carbonate of lime). Being brittle, cracks occur in this soil, and in this way impurities may be washed down through these into the pure water below, thus endangering its safety as a source of supply.

Waters which are good for drinking are those from uplands and mountains, from springs and deep wells, and from rain if it be kept pure.

Those which *cannot be relied on as being safe* are rain-water which has been stored carelessly and water which has passed over cultivated (*i.e.* contaminated) land.

Dangerous waters are those drawn from contaminated rivers and from shallow wells.

Hard waters do not cause soap to lather well, and in consequence a great waste of material occurs. This may be remedied by first boiling, and then straining the water through a fine cloth. If the hardness is due to Sulphate of Magnesia, this

method will have little or no effect. If caused by Carbonate of lime, the boiling drives off the Carbonic acid, and leaves an Oxide of lime, which forms a sediment, and if strained off, leaves the water "softer." This is known as "removable hardness" in consequence, and the other as "permanent hardness." Sea-water contains these Magnesium salts in large amount, and, as is well known, does not lather with ordinary toilet-soap.

Hard water is not good for making soup, as the full "strength" of the meat is not extracted, nor is it suitable for coffee or tea. The colour and flavour of vegetables boiled in it are also deteriorated. Hard waters form "fur" on boilers and pipes (salts of Lime and of Magnesia), and this causes loss of heat and waste of coal. Such water, if not too hard, has a pleasant taste. It also has one redeeming feature—it will not dissolve lead in water-pipes, because the leaden surface is protected by the lime salts deposited thereon.

Fur is removed by scraping the boiler, and the heating power of the latter is increased in consequence.

Soft water is good for washing, as it lathers freely. Rain-water is the softest known in Nature. It is not palatable to drink, and may be very impure, as already explained. Soft waters dissolve lead easily, and so are liable to cause poisoning, and waters which are acid will all the more readily

do so. This acid may come from peaty soil, because it contains certain acid-secreting bacteria which are washed into a stream by rain. Acid gases in the atmosphere of towns may be dissolved in the rain as it falls, or acids from manufactories may enter a river which is used as a source of drinking-water, and so act on lead-pipes, as we have already seen.

The following are the symptoms of lead-poisoning (or "Plumbism"), some or all of which may be present at the same time: Anæmia, with marked pallor, a blue-black line (or series of small dots) on the gums near their margins, attacks of pain in the abdomen (lead colic), and paralysis of the muscles which extend the wrist, causing "wrist-drop." The ankles are not often affected, but if they are, the method of walking is peculiar, and is described as the "high-stepping gait." The *hands are usually the first affected.* In those who experience a tingling of the feet and hands, and in whom both foot-drop and wrist-drop are present, *the feet being usually first involved,* the probability is that another cause is at work.

We shall, when considering water-fittings, discuss the means for preventing lead-poisoning.

The following diseases can be spread by contaminated water:—

$$\left.\begin{array}{l}\text{Typhoid Fever,}\\ \text{Cholera,}\\ \text{Dysentery:}\end{array}\right\}\text{ by germs only.}$$

Diarrhœa: by germs or by other irritants of the Alimentary traet.

Parasitic Diseases: by worms or their eggs in drinking-water. Infeetion oecurs in some cases direetly through the skin by the parasite boring its way into the body.

Poisoning: by substances dissolved in the water, chiefly by lead, less often by eopper and zine. The water in sueh eases has been eontained in pipes, cisterns, or taps made of or eoated with these metals, whieh it has dissolved.

The quantity of water drunk by a healthy adult varies with temperature and elimate and also with personal habits. An average of 3 pints in 24 hours is a fair allowanee for an adult. If to this be added the amount employed for eooking, washing, the lavatory, &e. (where the house has water "laid on" by pipes, &e.), and *allowing for unavoidable waste*, about 15 gallons per day per adult is suffieient. *This does not include* the supply for a large daily bath, which alone would need about 30 gallons. Where there is no regular supply of water the amount used is usually much less, but this does not eontribute to ideal eleanliness being observed. Patients need more or less according to eireumstanees. In General Hospitals the quantity per bed has been found to vary between 40 and 50 gallons. Some people drink too mueh water at the eommeneement of or during a meal. This eontributes to loss of

appetite and indigestion. Children are frequently the offenders.

In large towns, where water is necessary for irrigating the streets, drains, &c., and for trade purposes, large supplies are required. In London the average amount available is about 35 gallons per person per day. In Edinburgh this is exceeded, and Glasgow provides about 60 gallons per head. Dublin has about the same quantity as London. In all cases a great deal runs to waste. In ancient Rome 300 gallons daily per individual were available, and our Engineers of to-day examine with interest and admiration the aqueducts and baths of two thousand years ago!

CHAPTER V

WATER—PURIFICATION. DOMESTIC SUPPLY

We have next to consider the Purification of Water. This is done by the Water Companies which provide a public supply. Where this is not so, and people have to supply themselves from streams, wells, and pumps, there is a very great and ever-present danger of infectious diseases being spread by the impure water which is drunk. Nurses should thoroughly appreciate how great a risk there is, and also how, with care and attention to simple details in the house, this danger can be avoided. It is their duty to instruct their patients how this can be done.

We shall first consider the purification of water by: I. Public Authorities; II. Privately at home.

I. Filter-beds at Waterworks

The water from a river is taken where the stream is least contaminated. It passes into large inlets, which are screened at the entrance to keep out objects of any size. These pipes lead to a

"settling tank," where the larger particles, &c., sink to the bottom, and are removed by being dug

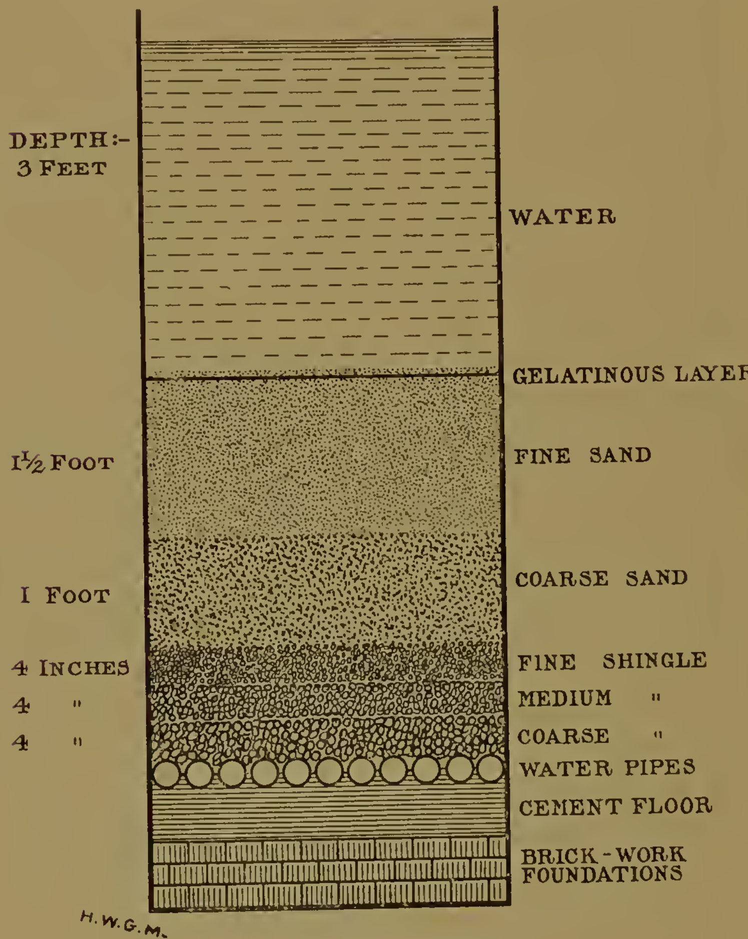


FIG. 15.—Section of Filter-bed.

out from time to time. The water is next admitted to the "*first filter-bed*" (Fig. 15).

1. This consists of *layers of sand;* the uppermost are of the finest quality, having very small grains,

and being quite clean. It has *beneath it a layer of a coarser quality.* These two together are from 2½ ft. to 5 ft. thick.

2. *Below the sand* there are *three layers of shingle* —the upper one fine- and the lower one medium-grained, as is the sand. These are each from 4 to 6 in. thick.

3. Next, there is a layer of coarse shingle, pebbles or stones, to allow the filtered water to pass freely, and to prevent the sand from choking the pipes.

4. At the bottom of the filter-bed are stoneware water-pipes which are perforated and rest on a cemented brick floor. These are 3 or 4 in. wide, and convey the water to another filter-bed of the same kind as the first for further purification. The water trickles down through these beds at the rate of 4 to 6 in. in one hour, and enters the storage reservoirs from which it passes into large pipes known as "water-mains," which carry it all over the district to be supplied.

Large iron filter-beds are also used. The water is pumped into them and percolates through layers of sand, &c., placed in removable shelves. They are contained in buildings to prevent the water freezing, and are raised on pillars.

The sand used by the drinking-water companies has the finest grains and is the cleanest obtainable, but it is useless for *purifying* the water until a

"gelatinous layer" has formed immediately beneath the upper surface of the sand. This stratum is deposited quite naturally in the course of three or four days, and is about 1 in. thick, and it is *chiefly by this layer that drinking-water is properly purified.* In it there are certain bacteria or germs which help to arrest the dangerous germs in the water, and to destroy them. This gelatinous matter is sticky, and therefore it acts in another way—holding, like glue, the dirty particles. In this manner it performs the part of a strainer or sieve.

Then there is a third action. In this upper layer of sand there is a gas known as Oxygen, and this gas "oxidises" some of the particles. Animal matter when so acted on by Oxygen is thereby rendered far less harmful and less infectious, if not absolutely "sterile." This oxidising process also occurs over a weir, where the water foams and mixes with the air (which contains Oxygen), and the gas gets dissolved in the water, and thus helps to purify it. The same thing occurs in the waves at sea; and where a stream rushes over a rocky bed or falls from a height. Oxygen also assists in destroying germs in water, for there are certain bacteria which cannot develop or live in the presence of this gas.

Thus we have three actions taking place in the gelatinous layer of the sand:—

1. Bacteriological: The action of living germs on one another.
2. Mechanical: Straining of the water and adhesion of the germs to the gelatinous layer.
3. Chemical: Action of oxygen on animal matter and on microbes.

After a time this slimy layer becomes perfectly waterproof, like "flexible collodion," which is used by Surgeons for protecting wounds. It is then useless, as the water cannot pass through and the filter-bed will not work. The upper layer of sand for a depth of about 1 in. is therefore scraped off, and purified by being heated, which kills all germs. It is then washed with pure water and dried, and is replaced in the filter-bed for further use. In this way very few germs are able to pass into the drinking-water, and it is thus rendered safe. Dissolved poisons, however, cannot be removed by this method, and their presence, whether from putrescent animal or vegetable matter, or from trade processes such as metal-works or dye-works, is guarded against by Acts of Parliament, &c., concerning the pollution of rivers and streams.

One filter-bed is not sufficient; there must be several, so that they can be used in turn, some working whilst others are being cleaned. After they have been refilled with water the gelatinous layer takes, as we have seen, three or four days

to form, and the filter-beds are then ready for employment.

Purification of Drinking-water-supplies by the Electric-light.—This is of recent date and the rays used are similar to those of the Finsen lamp used for treating Skin-diseases (Fig. 16). The water to be purified enters by R, passes into

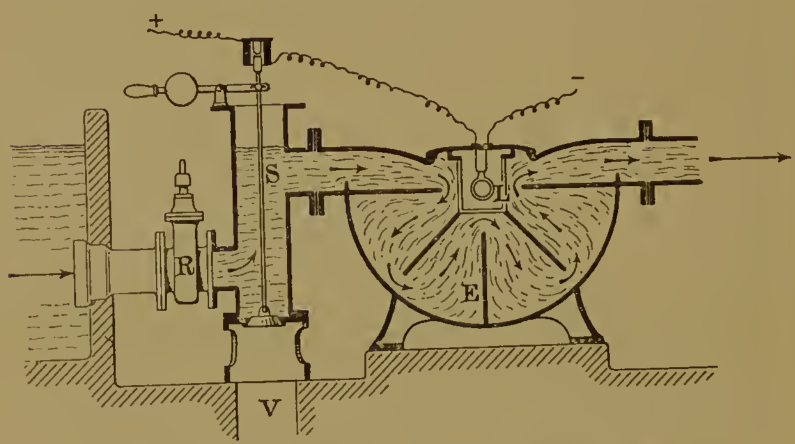


Fig. 16.—Purification of Water by Electric Rays.

each compartment of E, where rays from the electric-lamp L destroy the germs. If the lamp goes out the water is automatically turned off from S, escapes down V, and so does not enter the pure-water Reservoirs.

From the "mains" smaller pipes branch into side streets, and from these still smaller "service-pipes" (of lead) convey the water into each house. It is essential that the occupier of a house should

know the position of the stop on the service-pipe, called a "stop-valve," in order to be able to turn off the water if the pipes burst. There are, opposite every house, turn-off cocks in the pavement by which the Water Company can shut off the supply. The water passes through service-pipes into the drinking-water cistern at the top of the house, and from it it is conveyed by small pipes wherever required in the house.

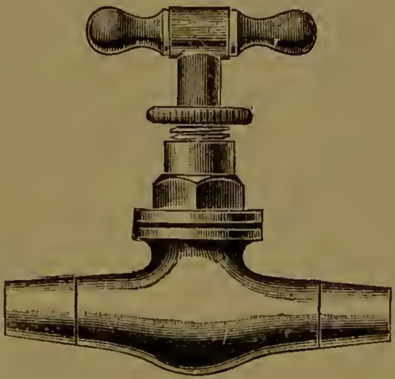


FIG. 17.—Stop-valve.

The lead pipes, however, are sometimes dangerous, because they may cause lead-poisoning. This is especially the case if the water is (*a*) at all acid and (*b*) the *lead new.* An acid water acts on and dissolves lead readily. Soft water is very pleasant for use, but the drawback to it is, that it has a tendency to act on lead and so may cause "Plumbism," the symptoms of which have already been described (p. 60).

To prevent lead-poisoning one of two methods can be adopted: (1) Either supply such *water as will not act on the lead pipes*; or (2) use specially constructed *pipes which will not be affected by the water.*

First, as regards the *water*: If it is non-acid and not very soft, there will be no corrosive and dissolving action. If it is unavoidably acid, the authorities render it less so by passing it through layers of flint, or by adding to it very small quantities of chalk or soda. This has been found to be efficient.

Secondly: The pipes must be rendered safe from attack if the acidity of the water cannot be removed. 1. Newly-made lead pipes are to be avoided. 2. They may have an internal protective lining which will not be affected, and prevents the water coming in contact with the lead.

Internal Coating.—This may be (*a*) of tin, but this is too easily broken; (*b*) of glass, which is practically useless for the same reason; (*c*) of cement, like PORTLAND CEMENT. This is the best. (Iron drains and sewers are also so lined and are then known as PARGETTED PIPES. These are largely replacing those of stoneware.)

By Law, the Sanitary Authorities in Towns and in the Country are bound to see that there is a *sufficient* supply of *pure* water in every house in their districts. This applies to all houses which are *already inhabited* or *are to be occupied.*

The Law is in force in London, "England and Wales," Scotland, and Ireland.

In London every occupied house not having an

adequate supply of pure water can be closed by Law and the occupants be compelled to leave it; and all houses when erected must have a sufficient supply of pure water.

In the country no newly-built house can be inhabited unless a certificate has been given by the Medical Officer of Health that it has been properly supplied with water or has a good supply within reasonable distance. Nurses will see how very important a matter this is. Sometimes the inhabitants have to provide themselves with water as best they can, and in these cases the usual source of supply is an impure stream or shallow well.

II. How to Purify Water at Home

1. The *simplest method is to boil the water.* This destroys the dangerous germs in it. The water can then be strained to remove any coarse particles. Mere straining without boiling will not remove germs; being extremely small, they pass through in the water.

Boiled water always has a "flat" taste. This is because the air which was dissolved in it has been driven off in the process of boiling. This can be remedied by pouring the boiled water at a height from one (clean) jug into another several times so that bubbles form in it. The

air gets re-dissolved and the taste becomes palatable.

2. *Distillation* is another method of purifying water, but needs special apparatus. The water is boiled, and the steam is cooled down in a tube surrounded by cold water till it condenses into water again.

Distilled- like boiled-water is also "flat," and can be similarly treated. Both must be stored in *clean* vessels which should not be made of lead or of galvanised iron (iron coated with zinc by the action of electricity), because both easily dissolve lead; and also zinc, to a lesser extent.

3. *Domestic Filters.*—These can be purchased and are of various kinds. Some of them are dangerous frauds because they promise much and perform little. Others are excellent for purifying water. The essential points of a good filter are:—

I. It must absolutely purify the water, that is to say, remove all germs.

II. It must allow the water to pass through fairly quickly.

III. It ought not to be easily broken.

IV. Its purifying power ought to last for some time, to avoid frequent cleaning.

V. It must not be too expensive, or people will not purchase it.

VI. It must be easily cleaned.

VII. Its parts should be readily replaceable, and not complicated in structure.

VIII. It should be portable, if required when travelling.

Taking first those which are to be *avoided* :—

1. The most common is the Carbon-Block filter. It is quite useless for purifying a water containing living germs. These easily pass through the "block," which is made of porous "carbon" or charcoal. The germs form a colony in the centre of this, grow and multiply there, and contaminate the water constantly.

Filters containing *layers* of charcoal are equally useless. These only remove the coarse particles from water.

2. Sponge-filters are worse, because they have large open spaces in them, and become greasy and sticky. Germs develop on these surfaces, and contaminate the fluid.

3. The magnetic-oxide-of-iron filter is useless to arrest germs.

The filters to be relied on are those which have *very minute pores* through which water can slowly trickle but *germs cannot pass.*

They are really strainers with the smallest possible openings. The material of which they are made varies a little, but the pattern is much the same in all. There are several good ones on the market, and the best are:—The PASTEUR-

Cartier
CHAMBERLAND, the BERKFELD, DOULTON'S, DUFF'S, SLACK and BROWNLOW'S, &c.

These filters usually consist of two parts:—

(1) The outer case, which may be of metal (Fig. 18), or it may be a large one of stoneware containing several filter-tubes (Fig. 19). In the simplest forms the metal case joins on to the ordinary water-pipe.

(2) Inside this is the filter proper, consisting of a hollow tube (called in French the *bougie*, or candle). It is made of a porous earth hardened by baking, so as to form unglazed "porcelain."

The filter acts in this way: the water passes inside the case between it and the filter-tube (*bougie*). By pressure it is forced through the fine pores of the latter and *leaves the germs on the outer surface* of the porcelain. It then runs out of the lower part of the *bougie* either continuously into the receiving-vessel, or, when wanted, by turning a tap. In the larger filter the water is forced upwards inside the *bougie* and descends by a central pipe into the lower chamber.

It is necessary to remove the "candle" from time to time to clear it of the germs. This is done by scrubbing it gently on the surface with a soft and wet brush, else the pores will be choked-up. These tubes are very brittle and break easily, so they must be carefully handled. They should next be placed in boiling water, and *allowed to cool slowly*

after being taken out, to prevent them cracking. They are then ready again for use.

A simple filter can be made with layers of sand

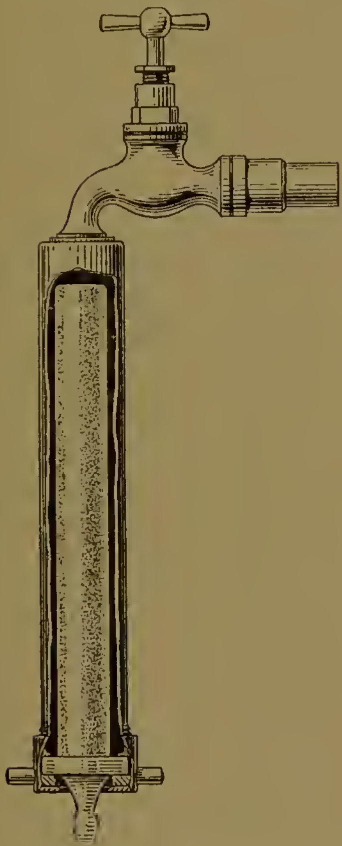


FIG. 18.—Single Filter in Metal Case attached to Water-tap. (Pasteur-Chamberland.)

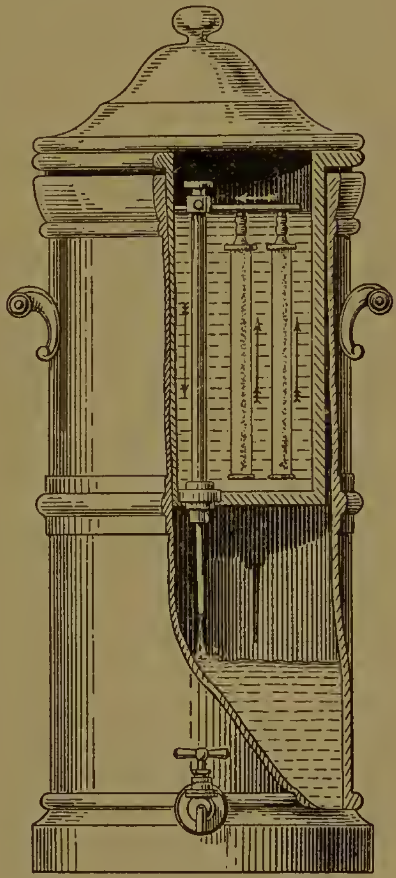


FIG. 19.—Several Filters encased in Stoneware.

and gravel, after the plan of those in Public water-works. A clean metal bucket, with holes in the bottom, is partly filled with a layer of fine gravel

which has been cleaned and sterilised in boiling water or by fire-heat. It should be 3 or 4 in. deep; over this is a layer of coarse sand similarly treated, and above it a stratum of fine sand also purified, all of about the same depth. The water percolates through from above downwards, and escapes into a second, similarly constructed, filter, and then into a clean receiving-vessel which is protected from dust, &c.

Clean flower-pots, two in number, each separately filled as above, will also do; the water drops from the one above into the one below, and then into the receiver. It is kept pleasantly cool, but will freeze if the temperature is low. These methods are useful (*if better ones are unattainable*) for a water *fairly pure from the first;* if contaminated already, the germs cannot be removed by this plan. BOILING IS FAR SAFER, followed by filtration or straining.

4. Muddy water can be made clear by simple *Sedimentation.* The water is allowed to stand undisturbed. The upper layer of water can be drawn off without stirring up the deposit. The *water may be strained* through clean, fine cloth or fine wire, as in a sieve. None of these methods is of use against such small organisms as microbes; they only separate large particles of dust and dirt, and are worthless to remove germs.

5. *Chemicals.*—About 5 or 6 grains of Alum added to one gallon of turbid water render it clear

by causing a deposit of the suspended matter. The *alum* can be placed in bags of fine muslin, which are shaken up in the water, which is then allowed to stand for some time till a sediment forms at the bottom. The alum on settling takes down with other *débris* some of the germs suspended in the water, and so renders the uppermost layers *less impure, but only to a certain extent,* as it cannot cause them all to sink, and *does not destroy any.* It is therefore *not a safe method,* and is only able to cause a deposit of the coarser particles floating in the water.

Permanganate of Potash or of Soda renders water less impure. (This salt is contained in "Condy's Fluid.") The oxygen given off by it acts on *dissolved* animal and vegetable matters and renders them *inert.* It also removes the smell from water. It does not completely purify it; and were the salt added in sufficient quantity to destroy all the microbes, the *water would be unpalatable and therefore undrinkable,* on account of the quantity of permanganate in it.

The Storage of Water in Cisterns

Water must always be kept in clean vessels, and be protected from dust, germs, insects, mice, &c. The cistern must be of convenient size, be readily filled and cleaned, easily accessible, and well guarded against cold (to prevent freezing) and against great

heat (to keep the water pleasantly cool, and to prevent it evaporating). Filters or vessels containing water must be covered up, and should not stand near a sink, drain, or any place where there are bad smells.

Nurses should not keep water or any other liquid intended for drinking, or even lumps of ice, exposed in a sick-room. The latter should be wrapped in clean flannel which will also prevent it melting quickly. Supplies of ice obtained from impure water (as in polluted rivers and lakes) or kept in contact with fish and meat (as in shops) are dangerous and un-hygienic.

Rain-water is fairly pure if it has passed through a clean atmosphere and has been properly stored. Robert's "Rain-Water Separator" is a useful apparatus (a working model can be seen at the Royal Sanitary Institute in London). It is fitted with an automatic arrangement by means of which the earlier part of a shower, which has passed through a dusty atmosphere, or over a contaminated surface, is not stored but is allowed to run to waste. The later part of the shower which has fallen through the (re-purified) air, and over a surface already washed by the rain, is run into the cistern.

Drinking-water storage-cisterns of earthenware are very good although heavy. Those of slate are liable to leak, and the tiles are easily broken.

It is of the greatest importance when entering

a new house, or one which has not been occupied for some time, to see that the water-cistern *is clean*, is of a good pattern, and is in good working order. If neglected the cistern becomes very dirty, and is then a source of great danger to all who drink the water from it.

In Public places there are huge reservoirs for storing rain-water or purified river-water from Water-works; they are deep (to avoid freezing) and are carefully guarded against all sources of pollution. They are often at the top of a hill, or are raised on a water-tower for easy distribution of the water through mains and pipes all over the town.

The Water Supply of a House

Water is supplied by the Authorities and Water Companies by (1) the "Constant" and (2) the "Intermittent" System.

In the first method the water *is always in the house.* It enters by the "main," either by descending the aqueduct from a high reservoir, or is forced up by powerful pumping machinery. There is then no excuse for not using a sufficient quantity for domestic purposes, the drains can always be flushed, and cleanliness be ensured all round. *This is therefore the best system*, and it is the one advised to be adopted wherever possible. A constant supply may cause much waste of water,

but this can be prevented by having good fittings and exercising care. It is far safer to use too much water than too little.

In the "Intermittent" System, water is not always obtainable. When the pumping-engines cease to work there is no flow of water in the pipes, and therefore a large storage-cistern is necessary in all houses. In the "Constant" supply a cistern is really unnecessary, as every house-pipe is filled direct from the main, and is always full.

The *disadvantages* of an Intermittent Supply are:—

1. A complete stoppage of water during some hours (if the cistern is empty).

2. The danger of there being none at hand to put out a fire.

3. The danger of dirty water, foul air (full of germs) and gases being sucked into the water-pipes when they are empty or half-full. These impurities will be drawn in through any cracks or faulty joints in the pipes as the water recedes (to the lowest level), when the pressure of the pumping-engine ceases.

The Law demands that all Water-works must be able to deliver water up to the *highest point of the highest building in their district.*

Water-mains should be sunk at least 4 ft. underground to prevent the water freezing in winter.

House-builders often cause much inconvenience to tenants by exposing the water-pipes to the frosty

air outside the house. Supply-pipes should be inside the building, and ought to run near the hot-water pipes to prevent freezing, and both should be easily get-at-able throughout their course. House-builders and plumbers seem to desire to keep them out of sight and as inaccessible as possible—probably for reasons neither hygienic, nor æsthetic, but "commercial"—a "burst" in a hidden pipe being a most profitable source of income. Exposed pipes can be covered with felt or woollen material in frosty weather.

Water-Fittings in a House

The water in both systems enters from the street water-main by the "service-pipe." It should have a domestic shut-off tap, and the position of it, as has already been stated (p. 69), ought to be known to the householder. This pipe leads to the cistern, which must be well protected and easily accessible (which it seldom is), at the top of the house. It is not to be placed too near the roof, else it will be frozen in winter and hot in summer. It must *be cleaned from time to time*, especially when a tenant is taking a house, and also when a cistern has been out of use for a long time. It must be covered-in to prevent vermin, rats, mice, &c., dropping into it. In many cases attacks of illness, diarrhœa, &c., have been traced to a dirty

cistern. Few people think of having it cleaned *periodically.* This is done (1) by shutting off the water from the main, and (2) by scrubbing out the cistern with clean water and a soft clean brush. Particles of "fur" (from a hard water) must not be allowed to go down the outlet-pipe of the cistern, else the house-pipes will be choked. This is prevented by closing up the bottom-opening after emptying the cistern. When cleaned, and after all the dirty water has been removed (baled out), the supply is turned on (by the house stop-cock) and the cistern refilled. Care is to be taken to have all deposit on the sides, and all sediment on the floor of the cistern, cleared off; but if the cistern is of lead, and *the water-supply is an acid one*, it is safer to leave the "fur" (if it is not in a dirty or slimy condition), because, as already explained, it prevents the lead being attacked and dissolved.

The cistern is filled from the service-pipe by a ball-valve. The metal ball contains air, and floats at the end of a lever which opens and shuts the inlet-pipe. When the water runs out of the cistern the ball sinks and opens the supply-valve, when it floats up it closes it. It therefore acts automatically. An "overflow-pipe" passes from the cistern directly out to the open air *through the wall.* It prevents the house being flooded with water, and shows, by constantly dripping, when the valve is out of order and needs repair. This is

done by putting in a new "washer" (that being the trade-name), and the cost is little.

The water supply-pipes from the cistern extend all over the house, and must be fitted with good taps of the patterns known as the "screw-down" (Fig. 20). Those which allow the water to flow whichever way the handle is turned cause much waste and are prohibited by Water Companies, who *can take legal proceedings against people who have them, because of the unnecessary waste of water from negligence and carelessness in their use.*

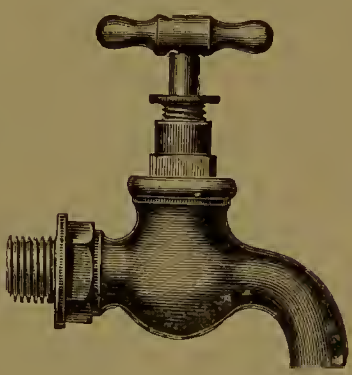


Fig. 20.—Screw-down Tap.

A pipe from the house-cistern supplies the *boiler*. Great care must be taken if the water in this pipe be frozen that the fire is put out, because should the boiler be empty and the fire be kept up, it will get red-hot, and when a thaw comes the water entering the boiler will be immediately turned into steam and so cause an explosion.

Houses with a W.C. system are supplied from the cistern, but the water must pass into a separate "flushing-cistern" or "water-waste preventer" holding at least 2 gallons and placed 4 feet above the seat.

Every house ought to have a *bath* supplied from the *hot- and cold-water cisterns* respectively. Under

the bath there must be a pipe for the waste-water, having a U-shaped bend in it. This is called a "trap," and as there is always some water in it, bad odours, foul-air, sewer-gas, &c., are prevented from running up the waste-pipe from outside, and entering the bath-room. There must be a "screw-cap" at the lowest part of the trap (Fig. 21). The waste-water runs down a pipe outside the house and empties into a "gully-trap," from which a drain-pipe passes underground to the inspection-chamber (Fig. 22).

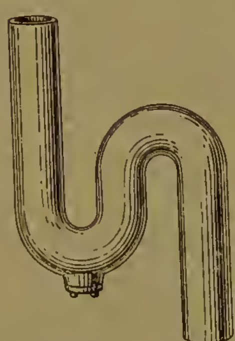


Fig. 21.—Trap with "Cap."

A very useful way to flush drains is to fill the bath with water and then let it run out. The rush of water scours out the drain. The bath itself should be raised on legs off the floor. Lavatories should have hot- and cold-water taps, and the waste-pipe must also be "trapped" and have a "screw"- or "inspection-cap," known also as an "access-screw."

This is useful to clean the U-bend in the pipe of anything which has blocked it, or any article which may have slipped down through the plug-hole; such as rings in lavatory-basins, sponges and washing-flannels down bath waste-pipes.

Housemaids' and scullery sinks are often allowed to be in an unclean condition owing to materials accumulating in them. They may be sources of

food-contamination and of ill-health. All basins (including lavatory ones) are to be of white, *leadless*, glazed stoneware. The floor of the sink must slope downwards to the outlet (waste-) pipe. The

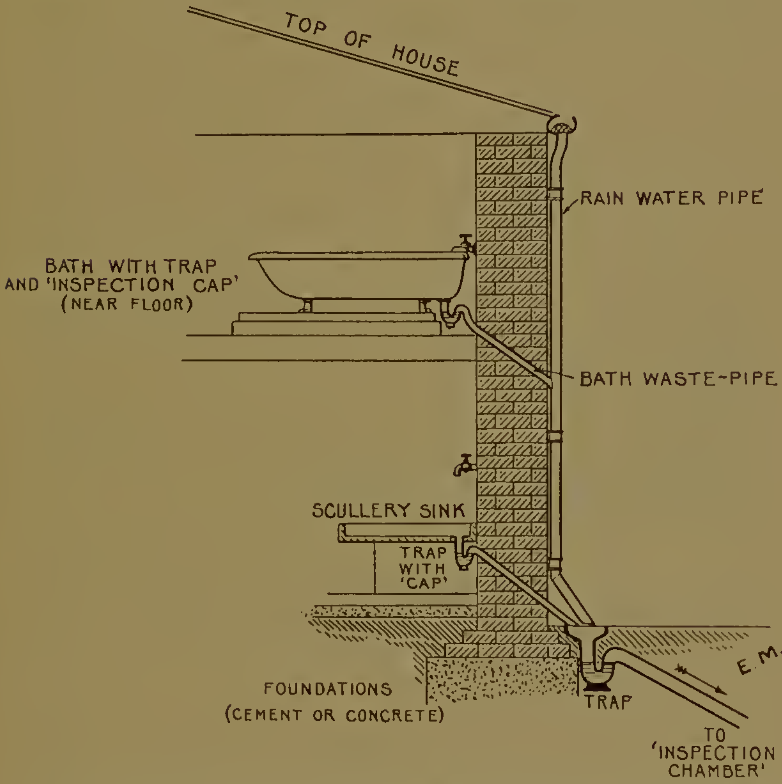


FIG. 22.—Rain-water Gutter and Bath Waste-pipe entering Rain-water Pipe, which opens (with Scullery Waste-pipe) over Gully-trap.

opening is to be fitted with a grating having apertures of the size of a pea, to prevent large particles passing down. The waste-pipe must be trapped, and have the "inspection-cap" already described (Figs. 22 and 23). It next passes through the house-

wall and discharges over a "trapped-gully" which passes on to the first "inspection-chamber." No waste-pipe ever opens into a soil-pipe. The scullery waste-pipe ought to discharge over a grease-trap (Fig. 24).

It is important to warn housemaids against

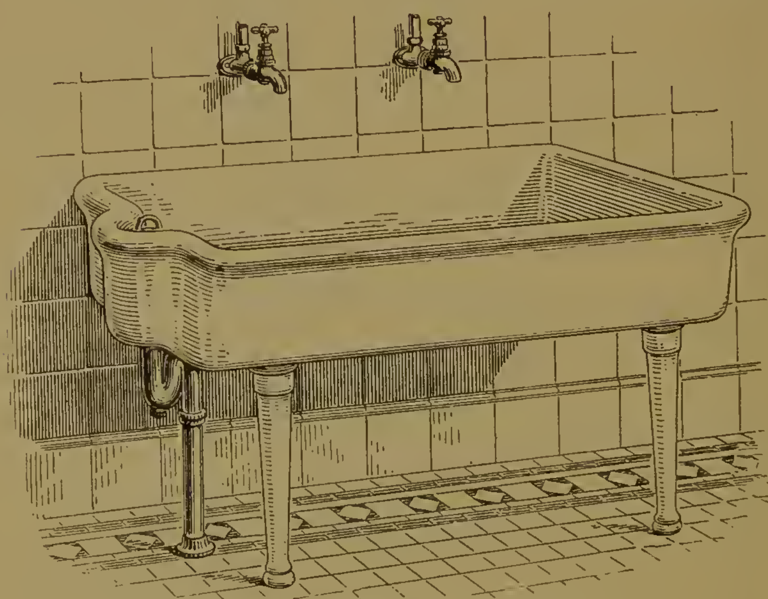


FIG. 23.—Housemaid's or Scullery Sink.

emptying slop-water down sinks. Rags, match-ends, hair-combings, and sundry articles of the toilet will certainly stop up the drains if they are periodically thrown down the sinks or the w.c. So will vegetable-parings, fruit-skins, and pieces of newspaper, &c. All these are *best burned* or put in the dust-bin if they will not cause a nuisance.

Strong acids if poured down sinks or W.C.'s, unless well diluted with water or neutralised by being mixed with an alkali, such as washing-soda(which will cause much effervescence), will corrode the metal pipes and ruin the drainage-system. It is also against the Regulations to do so, and a fine may be inflicted or heavy damages claimed.

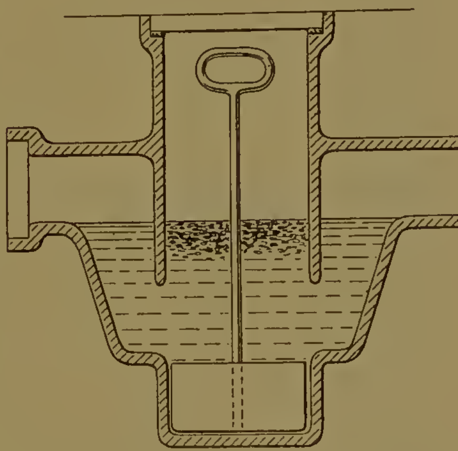


Fig. 24.—Greasc-intercepting Trap or "Gully," with Removable Bucket for lifting out fat floating on surface.

Hot-Water Supply

There are three different systems—the tank, the cylinder, and the "coil-inside-a-cylinder," but as the first is the one generally used we shall describe that one only, and as simply as possible (Fig. 25).

The supply of cold water from the house-cistern ought not to enter the boiler directly as this is inadvisable, as has already been explained. It *should enter the hot-water eistern* by a separate "feed-cistern.' From the hot-water cistern a pipe supplies the boiler and enters it *at its lowest part*. If this cistern contains warm water it is not likely to freeze in winter.

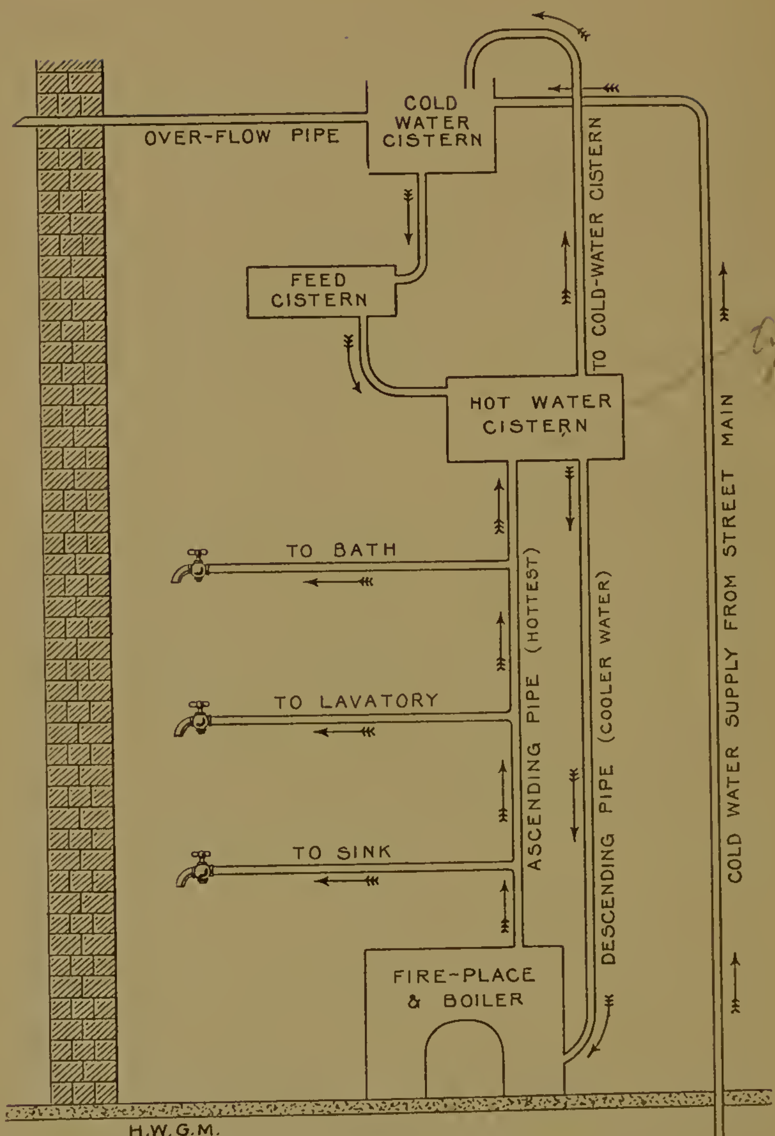


FIG. 25.—Hot-water System of a House. (The "Feed" Cistern is usually omitted.)

The water having been heated in the boiler leaves it by a flow-pipe which ascends *from the highest point of the boiler* (the water, being very hot, is light), and passes up to the hot-water cistern. *From this supply-pipe* (*which contains the hottest water*) "branch-pipes" run to the taps of lavatories, housemaids' sinks, baths, &c. The hottest water is always ascending *from the boiler*, and the cooler water, supplying it, is always descending from the hot-water-cistern to the boiler; and there is therefore a *constant* circulation. If cold-water pipes are placed near the hot ones (inside the house) they will not freeze. Every boiler must have a safety-valve to allow over-pressure of steam to escape and thus prevent an explosion.

In many houses the feed-cistern is absent, and there is only a cold- and a hot-water cistern; the former supplies, and the latter is supplied from the boiler in the usual way.

CHAPTER VI

DRAINAGE AND SEWERAGE

Efficient drainage is one of the most important things to render a place sanitary and its inhabitants healthy. Not only must it be applied to houses and streets, but also to the surface and subsoil of land in general. There are many towns which formerly were notoriously unhealthy, and had a high death-rate, especially among those suffering from diseases of the lungs—Tuberculosis in particular. Engineering skill has drained them; and in consequence they have become healthy. Places built on clay soil, and where there are marshy areas, suffer from dampness and cold because rain- and subsoil-water accumulate above this waterproof-layer of earth, and the houses have their foundations and walls constantly wet. The entire atmosphere contains an excess of water-vapour, and the inhabitants are thereby rendered more liable to suffer from Rheumatism and Diseases of the lungs. We are more concerned, however, with drainage as applied to dwelling-houses and the sites on which they are built, as also with

ground which is in their immediate neighbourhood. It is essential that all waste-water, excreta, and other refuse be removed as quickly and as efficiently as possible from all occupied places—houses or streets.

The term "sewage" is applied to the liquid and solid excreta, and to the water by which they are conveyed; and it includes the slop-water from dwellings, the waste-water from lavatories, sinks, stables, shops, and factories, and also the fluids, &c., off the streets.

Were these allowed to accumulate, not only would they create a nuisance due to their offensive smell, but the health of the inhabitants would certainly suffer, and from time to time outbreaks of dangerous infectious diseases would occur. Typhoid fever and Cholera, it is well known, are spread by infection from excreta which have obtained access to drinking-water, milk, and other kinds of food. Other infectious diseases if once they were introduced would, in a badly-drained and insanitary town, *spread with greater rapidity*, and *be of greater virulence;* for example, Small-pox, Plague, Diphtheria, Typhus fever, Measles, &c. There would be also a greater number of deaths.

The reasons for this are readily apparent:—(1) The germs grow quickly in the accumulated material; (2) they are spread everywhere by the diffusion of infectious particles by air, clothing,

traffic, &c.; and (3) the inhabitants having their health lowered by such unhealthy surroundings more easily fall victims to infection, being less able to resist it.

Drainage and Sewerage for the removal of excreta are carried out by two methods, known as the "Wet" and the "Dry" respectively.

1. The "Wet" System of Drainage

This is effected by means of water, as exemplified in the "w.c." It is the cleanest method, and the most rapid. It necessitates:

(1) *An ample supply of water;*

(2) *Properly constructed fittings and drains, &c.;* and

(3) *Efficient removal of the sewage.*

In many places where the *supply of water is insufficient*, or where there is a *difficulty in removing a large volume of liquid*, this method cannot be carried out, and another, usually the "dry system," has to be substituted. We shall consider each in detail.

Wherever possible, the water-method of removal ought to be adopted. In this the excreta are conveyed by specially constructed soil- and drain-pipes which pass from the house to the sewer in the street. This again discharges into a larger main-sewer; and by it the fluid is carried to special

sewage-filter-beds, or (without the use of these) is otherwise treated to render it less offensive and less impure, so that the fluid (or "effluent") may be allowed to enter a river, or (far better) to pass directly into the sea without causing a nuisance or being dangerous to health.

There are special Acts of Parliament which are in force throughout the country and lay down very strict Laws and Regulations for proper drainage and sewerage. The Medical Officer of Health of each place is appointed to see that they are properly carried out by Corporations, householders, tradesmen, manufacturers, &c. Persons who wilfully, *or in ignorance*, offend against these laws are liable to be heavily fined; and premises, including inhabited dwelling-houses, which are found to be in an insanitary condition can be closed by Law, and the tenants be compelled to remove elsewhere.

We shall first consider the Wet method for the removal of excreta.

The best position for the w.c., if it is fitted inside a building, is on the side of an *external wall*—not one dividing two rooms. There must always be a window which *opens directly to the outside air*, and the size of the aperture of which *must not be less than* 2 *ft. by* 1 *ft.* There must, in addition to this, be other means of ventilation, such as an iron grating, air-brick, or air-shaft.

In hospitals, as Nurses know, the W.C. is always "built out" at the end of a ward. It should have a short passage leading to it with a window on each side which can be opened. This allows air to pass across, and so prevents the direct access of effluvia from the closet into the ward. This is known as "cross-ventilation," and is useful *always*, whether in private houses or in hospitals, and especially so for a sick-room. Nurses will sometimes be asked to select a room in a house for a patient. It is always an advantage to have a W.C. within a convenient distance, especially in cases of operation and infectious disease, and it is to be remembered that such patients are specially liable to suffer from the access of contaminated air to their room; so also in all diseases which greatly weaken the patient, for example, cases of Diphtheria, Pneumonia, and the Infectious fevers. Nurses will appreciate the great importance of having thorough ventilation, and of seeing that the W.C. fittings are efficient and in a perfect condition of sanitation, or else the life of their patient and their own health will be endangered.

The walls of the W.C. must be kept dry and clean. The best wall-paper is one which is impervious to damp and is highly glazed, such as is used in bath-rooms. Ordinary plastering can be covered with paint and is washable. Better still are glazed tiles. Rough-surface papers are quite unsuitable

as they collect dust, and cannot be washed. "Distemper" is cheaper than oil-paint and better than wall-papers of poor quality, but it is liable to crack. In case of infection it is easily scraped off and the surface repainted with little expense.

The w.c. may be considered under three headings, which may be described as:—

1. **The "flushing apparatus:"**
   A SEPARATE *water-cistern.*
2. **The "receiving apparatus:"**
   The basin and trap.
3. **The "removing apparatus:"**
   The soil-pipe or exit-pipe, passing out to the inspection-chamber and house-drain.

1. The Flushing Apparatus

The water supply comes from the house-cistern. In former days the flush-pipe *passed directly to the basin of the closet,* and in consequence the drinking-water in the house-cistern was contaminated by sewer-gas and germs ascending by it. Outbreaks of Typhoid fever, Diphtheria, and other infectious diseases have been traced to this cause. It was also usual to let the overflow-pipe discharge from the drinking-water-cistern into the pan or trap of the w.c., and so the danger of infection was intensified. (Fig. 27.) All this is now altered. As has already been stated, the overflow-pipe from the

house-cistern must pass through the wall and discharge into the open air. The supply-pipe passing from it to the W.C. enters a separate "flushing-cistern" or water-box (known also as the "water waste-preventer). *By Law this must hold at least two gallons of water* (three gallons are preferable), and the floor of the cistern must be four feet above the seat of the W.C. This is to ensure an *efficient rush* of water; and the pipe from it which descends to the basin, and discharges the water round its "*flushing rim*," must have an *internal* width of at least one inch and a half, so that there is a delivery of sufficient force and volume. The waste-pipe (as in the house-cistern) passes through the wall and discharges any overflow into the air outside. Should this pipe be constantly running it shows that the valve in the inlet-pipe (coming from the house drinking-water-cistern) is leaking and needs a new rubber "washer." This is easily supplied and the cost is trifling, although plumbers are liable to take advantage of people's ignorance.

The flushing-cistern has a ball-valve, like the house-cistern, for refilling it when emptied. It is worked by means of a flushing siphon which is started by pulling the chain. By this a plug is raised at the bottom of the cistern, the water rushes out down the bent siphon-pipe, and continues to run till all has escaped. The ball-valve, as it sinks with the water, opens the inlet-pipe

and so re-fills the apparatus. The flush of water does two things—it removes all the excreta, &c., in the basin of the closet, thoroughly cleansing it, and then refills it, and also the trap beneath,

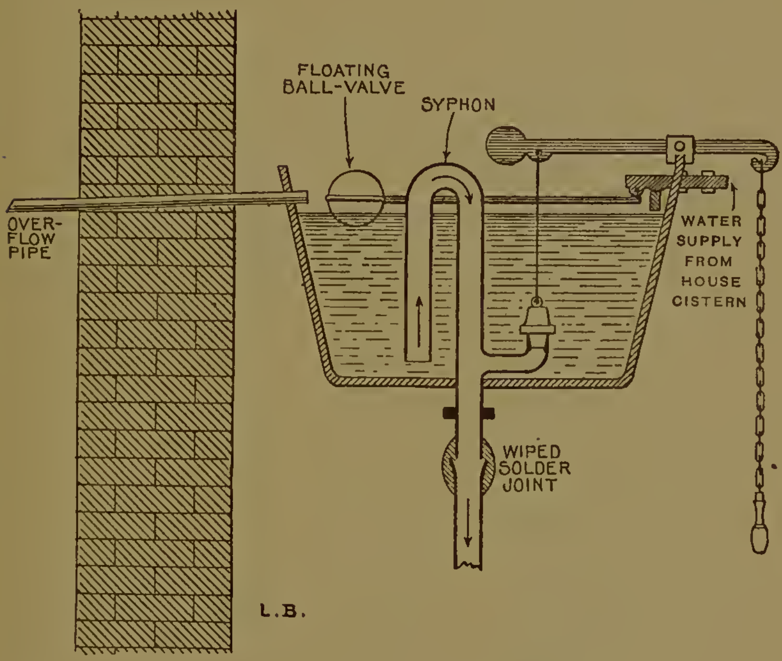


FIG. 26.—Good type of "Flushing-cistern" or "Water-waste-preventer."

with clean water. This water, which remains in the U-shaped "bend" of the trap, prevents sewer-air, germs, and bad odours from outside entering the house. It thus acts the part of a scavenger first and next that of a safe-guard.

2. The Receiving Apparatus, or Receptacle

(*a*) The Basin, (*b*) the Trap.

Of this there are several varieties, good and bad. Of the latter be warned against two of the worst kind: (1) The old pan-closet with a D-shaped (lead) trap, and (2) the "long-hopper" closet (the basin of which is funnel-shaped).

1. The first (Fig. 27) consists of four parts: the basin above; a hinged "pan" to hold water, at the bottom of the basin; an iron "container" within which the pan works, and the D-trap lowest of all. The basin was flushed directly from the drinking-water-cistern, as has been explained, and was often a source of infection. The "container" became a receptacle for the excreta, and was always in a very filthy condition, as the water never flushed it out completely. The D-shaped trap also was badly fouled and was never clean, and if the waste-pipe from the drinking-water-cistern discharged inside it one can understand how great was the danger of such an apparatus. The water was supplied by *drawing up the handle placed on the seat of the closet.* All closets having this arrangement *are to be suspected of having the D-trap* (although in some the handle is similarly fitted to quite hygienic closets with a proper trap and flushing-cistern).

The pan and D-trap are prohibited by Sanitary

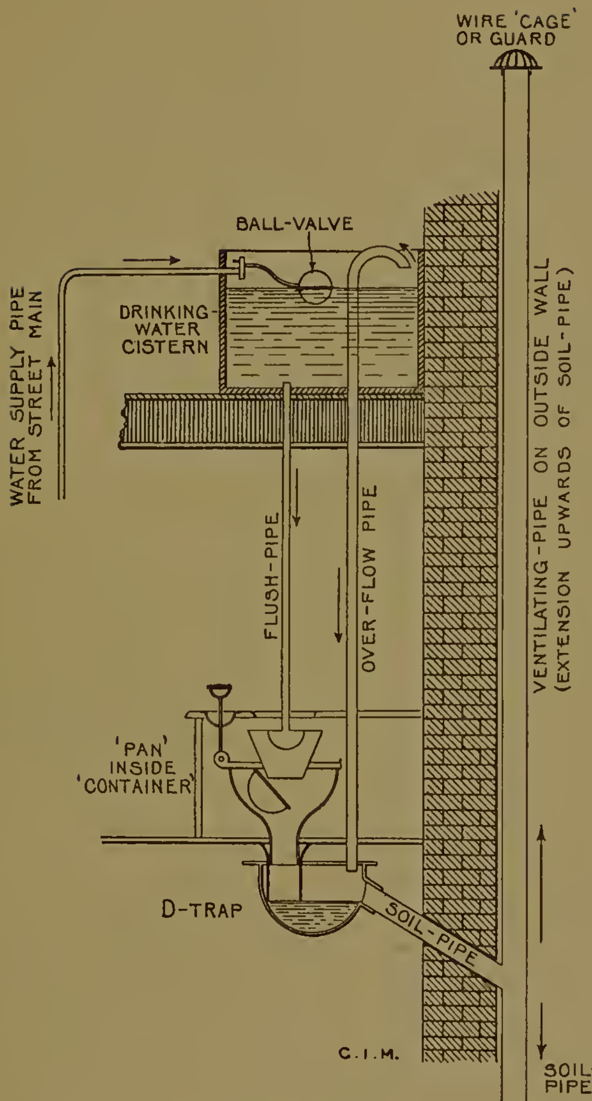


FIG. 27.—Contamination of Drinking-water Cistern by Flush- and Over-flow Pipes in Basin and D-Trap.

Authorities, and any installation of this kind can be condemned by the Medical Officer of Health, although many old houses still have them.

2. The "long-hopper" is most insanitary (Fig. 28). The basin (technically "hopper") is too long, and is funnel-shaped, and the "flush" descends

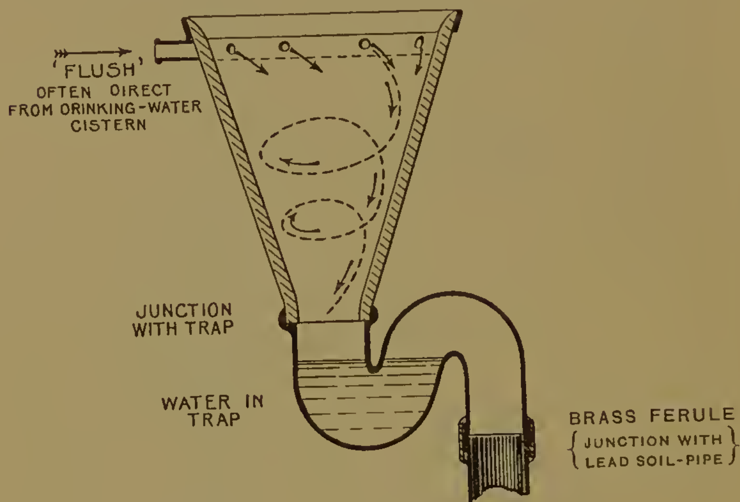


Fig. 28.—"Long-hopper" type (Bad).

in a spiral which only imperfectly cleans the pan. There may also be too little water left in the trap.

The basin, in all good patterns, ought to fulfil the following conditions:—

(1) It should be formed of *one piece throughout*; (but the trap may be joined on to the basin, and not be "all in one").

(2) The shape must be such that no part is liable to be soiled by excreta at the sides, or at the back.

(3) The flush of water must thoroughly scour it out, *i.e.* it must be self-cleansing when flushed. The material must be glazed stoneware, perfectly smooth and without sharp corners or angles, and preferably white in colour.

(4) It must contain water of *sufficient depth and of sufficient surface* (from the "after-flush") to prevent fouling, and to completely fill the trap.

(5) It should be simple in construction and not easily put out of order, all the parts being readily accessible for examination.

(6) A trap must always be provided below the basin, and be self-cleansing, like the basin.

(7) Just below the trap, from the upper part of the soil-pipe, there should be an "anti-suction" or "anti-siphonage" pipe.

(8) The apparatus must not be enclosed in wood-work, or boxed up in any way. This is to make inspection easy throughout, so that any loose joint or leakage will at once be detected.

There are many good patterns, and these may be divided into two classes, known as the "Wash-down"

and the "Wash-out"; the first-named is the best (Fig. 29).

It has a short "hopper" or basin of glazed earthenware with a "flushing-rim," and a lift-up seat. It can be used for slop-waters, but it must be borne in mind that match-ends, hair-combings, and other articles of the toilet, coarse pieces of paper and household rubbish *must not be thrown down these closets, or down sinks,* because they will block the pipes and the drains. Such articles should be burned.

The front of the basin has a sloping surface, the back of it is perpendicular, and the sides fairly steep so as to avoid fouling.

The trap is at the bottom of the basin in the shape of the letter U, and forming a junction with the soil-pipe. Water of sufficient depth is always in the trap to prevent the inflow of sewer-gas, and of effluvia from the drain outside. The basin (as already mentioned) and the outlet-pipe may be made in one piece, or in two parts carefully united.

This stoneware outlet-pipe is joined on to the lead soil-pipe. Here there is a difficulty, because it is not easy to render this junction of stoneware and lead perfectly air- and water-tight, as it must necessarily be. This is overcome in this way: a brass collar known to the plumber as a "ferule" or "thimble" is inserted to form a junction between

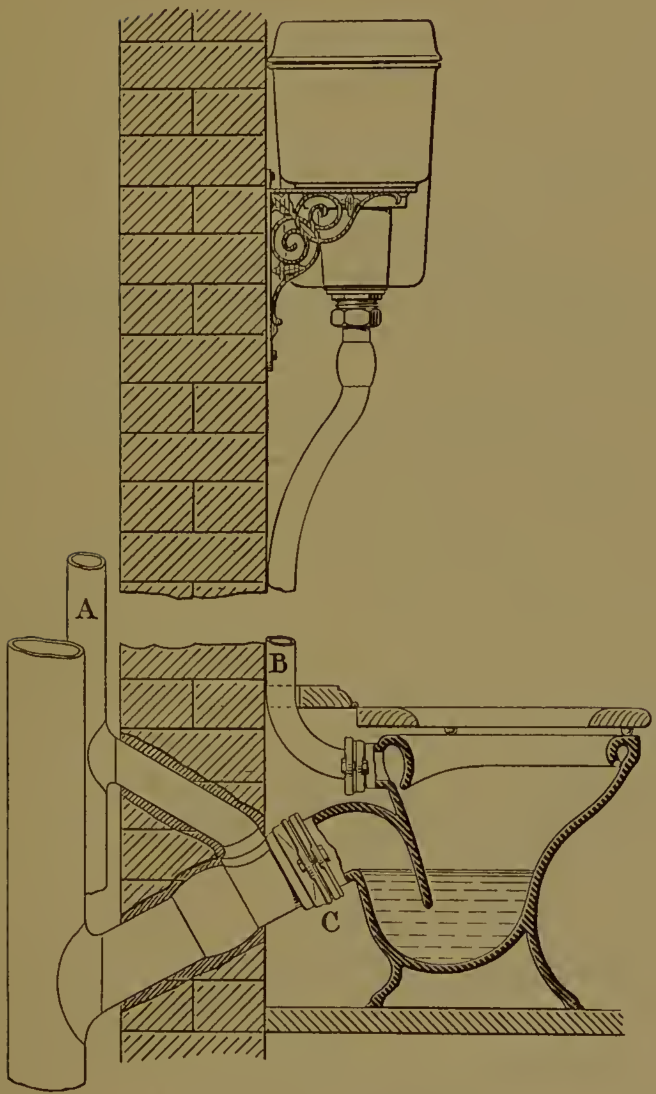


FIG. 29.—" Wash-down " type.

B. Flush-pipe ; C. Brass "Ferule" or "Thimble" ;
A. "Anti-siphonage"- or "Puff"-pipe.

the stoneware outlet-pipe and the leaden soil-pipe. It is *fixed to the earthenware by means of earth*—that is, *by Portland Cement* ("earth to earth"); and the brass ferule is at its other end joined on to the leaden

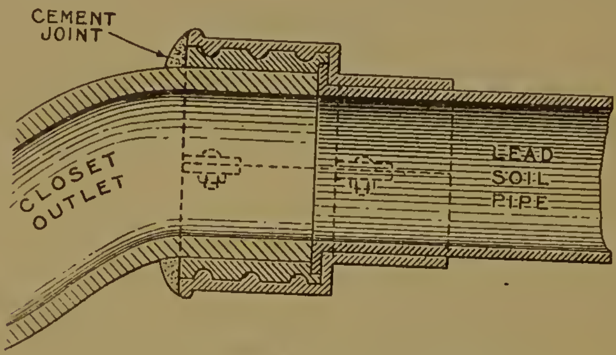


FIG. 30.—Brass Ferule or Thimble Joint.

pipe by solder ("metal to metal"). (Figs. 29 and 30.)

A special joint known as the METALLO-CERAMIC for joining lead and stoneware is quite good, and this is done by means of platinum.

3. THE REMOVING APPARATUS

The outlet-pipe turns downwards before it joins the lead soil-pipe which then passes through the wall of the house, runs down the outside wall, and descends to the bottom when it passes underground till it comes to the Inspection-chamber.

Before the outlet-pipe passes through the wall it has at its upper surface an ANTI-SIPHONAGE (or

"puff") pipe at a distance less than one foot from the highest part ("crown") of the trap (passing from C to A). (Fig. 29.) It is intended to prevent the water in the trap being sucked out when the contents are flushed out and rush down the descending soil-pipe. This last pipe when outside the walls passes in two directions: *downwards* (as already explained) and *upwards*. (Fig. 27.) Its upward extension, known as the "ventilation-pipe," must be of the same internal width throughout as the soil-pipe. This must be *at least four inches* (internal diameter). The soil-pipe running vertically down the external wall receives branch-ones from any other w.c.'s in the floors above or below. It must have no sharp bends or angles in it, and its upper extremity (the ventilation pipe) must reach *up to the level of the ridge of the roof*. At this point it is open to the air, and allows all sewer-gas and effluvia from the soil-pipe to escape harmlessly. This opening must not be near to, level with, or below the window of any room, *but well above* the highest opening. This is to prevent these gases getting into the house. Attic-windows may be carelessly built, those of the "dormer" or projecting pattern are often dangerously near these drain-pipes. Every care must be taken to prevent smells and gas obtaining access to the occupants. At the top of the ventilation-pipe a small open wire covering is usually placed, known as a "cage." (Fig. 31.) This

allows all effluvia, &c., to escape harmlessly into the atmosphere, and the wiring prevents birds from building nests there, and so closing up the end of the ventilation-pipe.

The anti-siphonage pipe which is placed beyond the trap of the W.C. passes outside the house, and may terminate in one of two ways: (1) it opens either into the ventilation-pipe; or (2) runs independently (as a separate pipe) up to the ridge of the roof. All these anti-siphonage pipes have open ends and contain air, and this cannot pass into the house because the water in the trap of the W.C. prevents this.

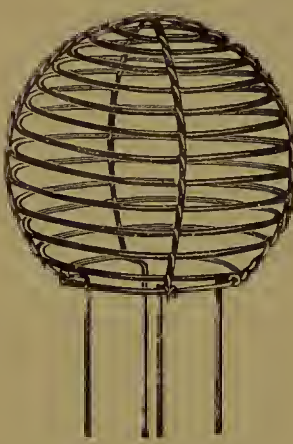


Fig. 31.—The Cage.

The other type is the "Wash-out" closet. (Fig. 32.)

It has two surfaces of water—one in the basin above, and another in the trap below (whereas in the "Wash-down" there is only one volume of water—the trap being part of the basin). The upper surface of the water is usually too shallow, and the excreta are not easily flushed over the ridge of the basin. The descending pipe leading to the trap is liable to be fouled. The closet otherwise resembles the former one, but it is not so sanitary, and the "Wash-down" pattern is to be preferred to the "Wash-out."

Another pattern known as the "Valve-closet" has an *up-lifting handle* (from the seat). It is complicated in construction and likely to get out of order. It is therefore not to be recommended, although quite hygienic, and is expensive.

The soil-pipe, best made of lead, passes vertically downwards outside the house wall. At the foot of this it ends in a stoneware drain-pipe *of the same internal diameter* which goes underground. It slopes downwards until it reaches the Inspection-chamber, known also as an "intercepting-chamber" or "man-hole." This is rendered air-tight by a closely-fitting iron cover (see Figs. 33 and 34) which can be removed for inspection purposes. The sides of the chamber are of brickwork lined with Portland cement or glazed tiles. It is ventilated by an air *in*let (or "vent") which has a mica-valve permitting fresh air to enter, but no effluvia to escape outwards. This inlet may be near the ground or well above it. The floor is of Portland cement resting on a foundation of concrete. This is to prevent any sewage leaking into the ground beneath. Along the floor, centrally from end to end, passes a straight half-open pipe or "channel" which is

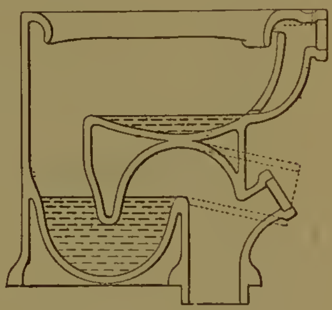


FIG. 32.—"Wash-out" type.

the direct continuation of the soil-pipe, the latter having entered the man-hole at its upper extremity. Into this central channel side-drains open (Figs. 33, 34, 35). These also are half-pipes or

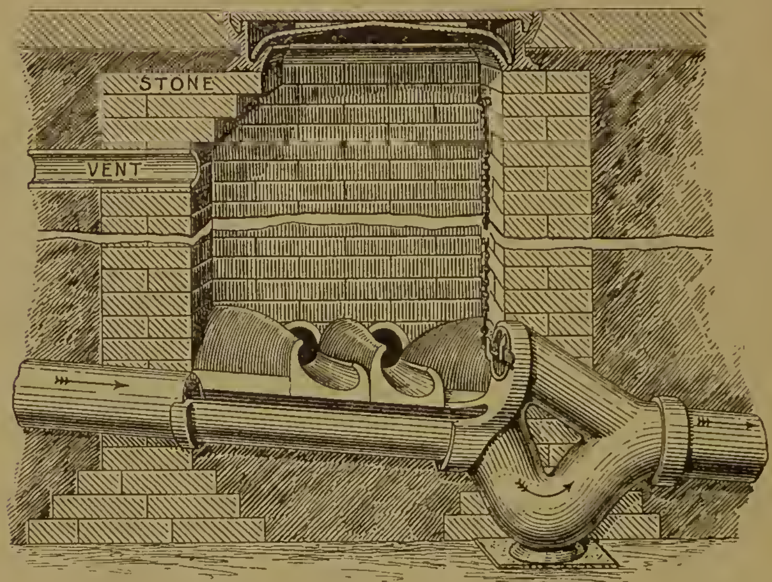


FIG. 33.—Inspection-chamber showing Air-tight Cover, Air-inlet or Vent, Soil-pipe entering on Left, Side-channels (Bath-waste, &c.) Joining Central (half-open Pipe) Intercepting-trap (Right), with Chained Stopper Closing Raking-arm.

"bends," and are the endings of the waste-pipes which carry water from the bath, lavatories, sinks, and from the rain-water pipes, each having its own side-drain. All these, as explained, have already been trapped. The central half-channel with its joining-drains ends at the lower end of the

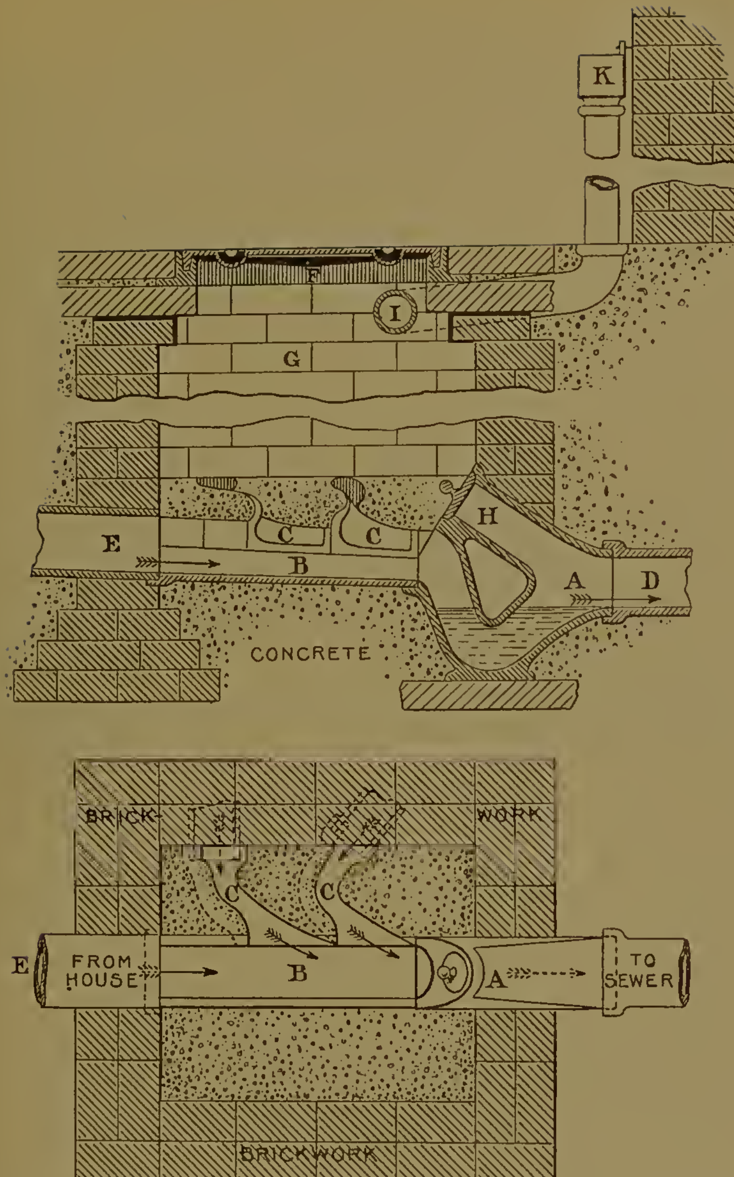


FIG. 34.—Inspection-chamber: Side View and "Flat" View. A. Trap; B. Channel Pipe; C. Side-pipes; D. Outlet (House-drain) to Sewer; E. Soil Pipe (Inlet from House); F. Cover; G. Wall of Chamber; H. Clearing (Raking-) Arm; I. Inlet for Fresh Air; K. Mica Valve Air-inlet.

inspection-chamber in a large stoneware "disconnecting-" or "intercepting-trap." It has the usual U-bend at its lowest part, and above this there is a straight pipe known as the "raking-arm" or "clearing-shaft," fitted with a removable stopper which acts as a plug. The other end of the raking-arm opens into the U-bend. Should the trap be clogged up, the stopper is removed, a "clearing - rod" inserted through the arm, and the obstruction pushed onwards towards the sewer. This can also be done by filling the bath in the house with water and then lifting its plug. A rush of fluid enters the inspection-chamber and may sweep away the obstruction.

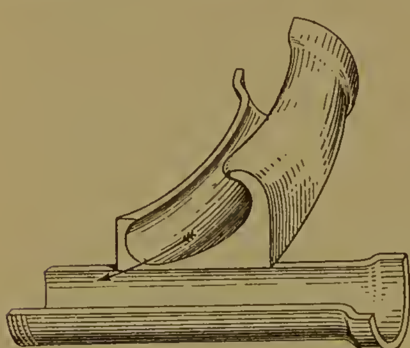


FIG. 35.—Side Drain Opening into Central Channel.

The outlet-pipe *beyond* the intercepting-trap is known as the *house-drain.* (D. Fig. 34.)

It will be seen that the soil-pipe enters the inspection-chamber at its upper end, the waste-water drain-pipes at its sides; that the intercepting-trap is at its lower end, and from it the house-drain emerges. All these channels slope downwards towards the nearest street sewer, into which the whole of the excreta and water from the house

passes. More than one inspection-chamber is necessary in large establishments. One must be placed at every angle or turning in the course of the soil-pipe or house-drain.

The soil-pipes, ventilation-pipes, half-pipes (in the inspection-chamber), and the house-drain must all be of the same bore throughout; the house-drain may be somewhat larger, as it contains *all* the fluid from the house. This internal width must be 4 *inches at least.* It is essential that these pipes all *slope downwards in the direction of the sewer*, otherwise the sewage will not flow onwards, but will accumulate. In places where the ground is flat and the "fall" insufficient, or where the drains are clogged with refuse, it is often necessary to open up the drains and remove the obstruction, either by passing rods (jointed canes) down them or by flushing out with a strong current of water. Flushing-tanks (which forcibly discharge water automatically from time to time) are sometimes necessary.

The drains are usually of stoneware, the soil-pipe of lead until it reaches the ground. The ventilating-pipe is also of this metal. The joining together of these lead pipes is effected by what plumbers term a "*wiped-solder joint.*" This requires *technical skill.* Men who wish to do cheap and bad work do not solder the joints properly, and may even use putty or red-lead for the purpose. This is dangerous, as the pipes will certainly leak.

The ventilating- and soil-pipes are to be made of what is known to the trade as DRAWN-LEAD or ROLLED-LEAD, so constructed that its overlapping edges are firmly welded together and will not gape open. "Seamed-lead" pipes must not be used, as the joinings will open out and cause a leak. The material must not be too thin, or else it will be easily worn through. A pipe having a width of 4 in. inside (of "4-in. bore") ought to weigh 8 lbs. for each foot of its length. The upper part of the ventilation-pipe (near the ridge of the roof) need not be quite as thick as the soil-pipe. The junctions of these to one another are to be made with "wiped-joints" (already described), and these should be at a distance of about 10 ft. from each other along the length of the pipe. To the outside of the building these pipes are fastened by means of plates of lead, known as "clips," which are nailed to the brickwork (Fig. 36).

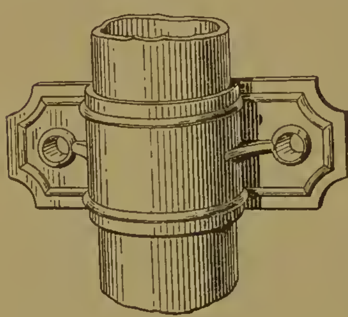


FIG. 36.—Pipe with "Clip."

When the drain-pipe (and soil-pipe) is *underground*, or if it passes *under the floor of a house*, it must be surrounded completely along its whole length with 6 in. of Portland cement or of concrete (cement and gravel). This is to prevent leak-

age into the ground or basement; and even if the stoneware pipe cracks the escaping fluid will still remain inside the cement. In the inspection-chamber the half-open pipes rest on 6 in. of cement (foundation).

The stoneware pipes have two ends; the *lower end* (" SPIGOT ") of one pipe fits into the upper and

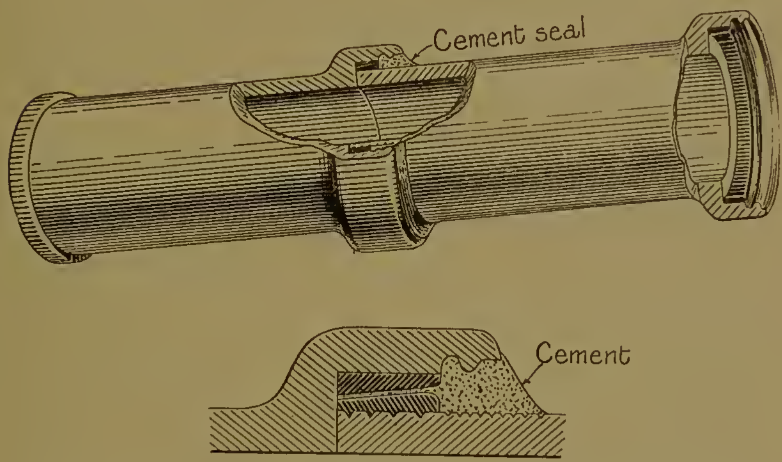


FIG. 37.—Junction of Stoneware Drains with Portland Cement.

wider end (" SOCKET ") of the next pipe. These junctions are grooved inside, and are made air- and water-tight by PORTLAND CEMENT. (Fig. 37.)

Iron pipes with a lining of cement (" PARGETTED," to obtain a smooth surface and to prevent rust) are better. They are not as easily broken as stoneware pipes and are lighter and stronger. They are now much in use.

Where a sufficient supply of water is not avail-

able, the waste-water of the house is used to flush out the closet.

These are known as SLOP-CLOSETS. A good pattern has on one side an AUTOMATICALLY ACTING "TIPPER": the bath- and sink-waters from the house run into a large vessel, which, when nearly full, turns over and flushes out the W.C. basin. The tipper then returns to its former position. On the far side the soil-pipe is trapped and passes to the street sewer in the ordinary way. This closet should be outside the house.

Street sewers receive the contents of house-drains. Those which also convey rain- and surface-water from the street "gullies" are of "the COMBINED system" of water-drainage. If the rain-water is carried separately in another pipe, and not in the main sewer, the system is known as the "SEPARATE" one. The latter has, in consequence, the disadvantage of a lesser volume of water for flushing out the sewer. The "Combined" system is on the other hand over-flooded when there is a heavy fall of rain. Both methods have their good and bad points.

The largest sewers are usually egg-shaped, and the smaller ones round. Those of large dimensions may be over six feet in height and are proportionately wide.

The ventilation of sewers is best effected by iron pipes raised high above the level of the ground, and

not placed near houses, but in wide open spaces. They discharge gases and effluvia into the atmosphere. The method of having ventilation-openings over the sewers in the form of iron gratings along the road is insanitary. The contaminated air ascending from them may be inhaled by people in the road, and may enter houses situated close by. In this way Sore throat, Diphtheria, and other infectious diseases may be spread by germ-infection.

The Testing of Drains

This must always be done before one takes a house. The landlord is by Law responsible that the drainage is satisfactory; if it is not, he is compelled by Law to have it put right, unless the tenant has made an agreement (when taking the house) to do so. This he should never do, because the Sanitary Authority (Medical Officer of Health) may condemn the system altogether, and much expense may be incurred.

1. The best test is by **water**. This is obtained from the nearest tap, and is run into the drain after its lower end has been plugged with a bag-stopper into which air is pumped to inflate it, and it is noticed if the surface of water (at the upper end of the drain) sinks after a certain time. If so, there is a leakage. This must be searched for. (Fig. 38.)

In a similar way the soil-pipe can be plugged

Fig. 38.—Water-test for Drains: Lower End of Drain Plugged; Water entering at Upper End from House Tap.

below and flushed with water from the w.c. above

it, and the level in the basin noted. These tests can only be made by experts and need careful manipulation. All newly laid drains *must* be tested.

2. The **smoke-test** is done by a special apparatus, and it is noticed if there is any escape of smoke

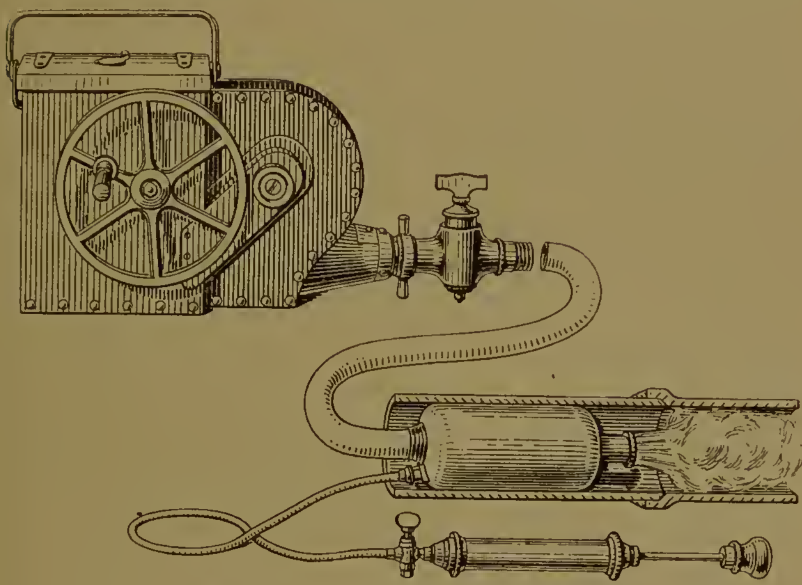


Fig. 39.—Smoke Test for Drains.

from under the floor, or from any spot where there should be no leakage. If found, the drains, &c., must be opened up and examined. This is not as reliable as the water-test. (Fig. 39.)

3. The **oil-test** is one of smell. From the top of the ventilation-pipe (ridge of the roof) peppermint oil is poured down, followed by several bucketfuls of hot water. If the odour is noticed in the rooms, &c., of the house, or basement, there is probably a

leakage, and this must be sought for at the suspected spot.

The same test can be applied from a w.c., but the smell of the oil may escape into the other parts of the house from here, and so cause a mistake to be made. It is better done from *outside* the house, and needs technical skill.

There are other tests, such as forcing air into a drain instead of water, and that of examining it by illumination, which need not be described.

It is not always advisable to employ a local plumber, or any one interested in getting the work, nor one naturally desirous of avoiding the cost of providing new drains. A reliable authority in Hygiene should be consulted, or the local Medical Officer of Health, who should be applied to for all information by an in-coming tenant.

CHAPTER VII

THE DISPOSAL OF SEWAGE

1. **The Wet Method.**—Crude sewage cannot be allowed to flow into a river or stream which is used for supplying drinking-water.

By sedimentation, by the action of light, nitrifying germs, water-bacteria, natural oxygenation, and the action of fish and plants, a stream can, as we know, to a certain extent be rendered less impure. This is more efficiently done in rivers of great length containing a vast volume of water. In Great Britain there are none such. Therefore the sewage must be specially treated to render it as harmless as possible before it is permitted to enter any stream. How is this to be done?

1. Discharge of Sewage into the Sea.—(*a*) In towns near the sea the sewage is allowed to run out when the tide is ebbing. It is essential that no nuisance be caused, and that all material be carried well out into deep water without fouling the shore, and that it will not be borne back again when the tide turns. Unfortunately this does occur, and it is therefore important at a bathing-place to be

sure that no such nuisance exists. At the mouth of a river it is liable to occur when the tide is "on the slack."

(*b*) Sewage can be taken far out to sea by steamers, and be there discharged. This is done in London by vessels ("Hoppers") specially constructed for this work.

2. Chemical Treatment.—Chemicals of various kinds are added to the sewage after it has been allowed to accumulate in large tanks. A deposit is formed at the bottom, and the fluid above this, if not too offensive, passes either at once into the nearest river, or is, after treatment, made to *flow over* the surface and then to *filter downwards through the soil* before entering a stream. The Chemical method is not a good one. The fluid is practically unpurified. The deposit in the tanks is known as "sludge"; it is sold as manure after further treatment, or is burnt in a "Destructor" furnace of special construction, and the ashes used for repairing roads or for mortar.

3. Land Filtration.—Sewage may be filtered through the soil in open fields by two methods.

One is known as "Intermittent Downward Filtration"—the soil itself being the filter. It acts mechanically as a sieve, and also chemically and bacteriologically by oxidation and by germ-action, thus resembling, to a certain extent, what occurs in drinking-water filter-beds. Six feet *below the*

surface of the ground porous earthenware pipes are placed which collect the filtered fluid and convey it to the river. The ground is divided into separate sewage filter-beds, and these are made to act in turn, hence the name "Intermittent" Downward Filtration.

The other method of filtration through the ground is known as "Broad Irrigation." The sewage is spread by pipes *over the surface of a very wide area*, as indicated by the name. Here the same agencies

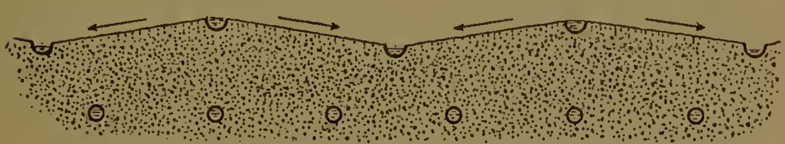


FIG. 40.—Broad Irrigation Sewage Carrier above, and Pipes below Surface.

are at work, and the fluid *after a certain time* soaks down into the soil, is received in perforated pipes (as in the first method) and can then enter a stream. In both these systems this "effluent" is fairly pure, and as river-water is usually filtered in specially constructed sand-beds (as we have seen) before use for drinking purposes, no harm arises.

In the "Downward-Filtration" Method the *surface of the soil is raised in ridges above the level of the sewage.* On these elevations *crops are grown.* They may be only of rye-grass, which is useful for drying-up the soil, especially when it gets water-logged after heavy rain. Vegetables are also grown,

and then these areas are known as Sewage-farms. (Fig. 41). In buying our domestic supplies one does not enquire whence they come. It is true that living germs of disease, and the eggs of thread-, round-, and tape-worms, &c., have been detected in vegetables polluted by sewage; particles of which

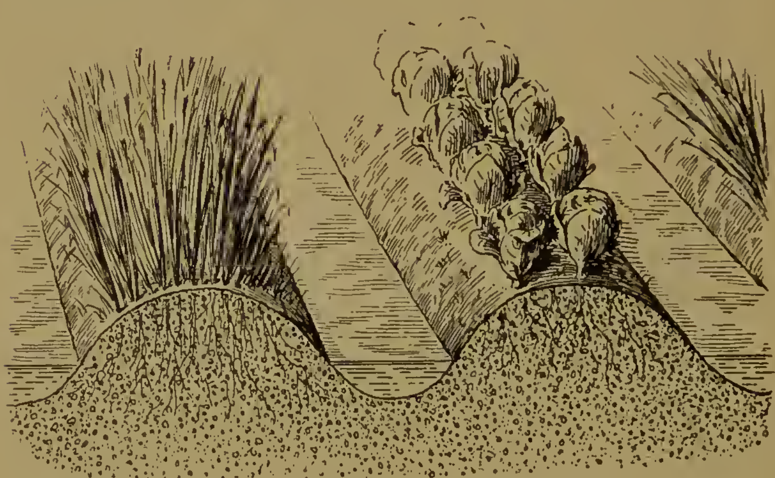


FIG. 41.—Intermittent downward Filtration: Ridges (with Osiers or Grass and Vegetables) and Furrows.

get entangled in the roots and leaves. These are removed by thorough washing, and rendered harmless by boiling, but the idea is not a pleasant one. A danger arises from using fresh vegetables, such as celery, radishes, water-cress, mustard-and-cress, which have been obtained from contaminated soil, or collections of dirty water where animals may have strayed. The same caution *applies to manured soil* where strawberries grow. All such ought to be

very carefully washed in a stream of water, as from a tap—vegetables before being cooked, and fruit before being eaten raw. It is also advisable to wash fruit which has been handled by unclean hands, or is exposed to the dust of the streets on stalls and barrows. On them virulent germs—such as the Tubercle bacillus—have been found, and cultivations made from them have grown in the laboratory. How little do people know of this danger!

4. The latest and best method is by FILTRATION THROUGH SPECIALLY PREPARED "TANKS" OR FILTER-BEDS. There are several types of this system, and in all of them are layers of small stones, gravel, or pieces of coke ("clinker"), and next come layers of larger size.

In this method (known as the "Septic-tank") the sewage enters:

(1) An *an-aerobic* ("*air-less*") *tank* in which the solids are dissolved by the action of living sewage-bacteria. The fluid next flows into:

(2) *Special filter-beds* where air is freely admitted, and causes oxidation, and to some extent purification, of the sewage. From these the "effluent" is made to trickle downwards through:

(3) Specially prepared layers of soil which purify it still more, and render it fit to enter the nearest stream by passing through underground perforated pipes, as a clear and bright fluid which ought to be free from smell.

In other systems the sewage is freely sprinkled over the surface of filter-beds by hollow perforated tubes which revolve horizontally (Fig. 42). The fluid then passes downwards, as already described. It is considered by some that this scattering of sewage in the open air over large surfaces allows infectious germs and contaminated water to be blown about indiscriminately by the wind and that this may cause the spread of disease.

2. The Dry Method.—This is not as good as the water-removal system (or Wet method). It has to be adopted: 1. Where there is an insufficient supply of water. 2. If the ground is so flat that the drains cannot have a sufficient downward slope ("fall"), and consequently the scouring is deficient. 3. The cost of providing a water supply, &c., may be too great. 4. In some cold countries the water in the drains freezes for long periods.

In country districts the household refuse, &c., is dug into the subsoil, where there are always active germs which in time render it harmless. This must not be done *near surface wells, springs, &c.* There is little danger if the excreta are well isolated, and are well covered up with a layer of earth at least two feet thick, and left undisturbed for about six months. The risk of contaminating water-supplies, such as shallow wells and streams, has already been pointed out. Germs may be carried by the wind, *from a loose covering of earth*, such as a layer of dry sand of

little depth. Open pits, "middens," and "cesspools,"

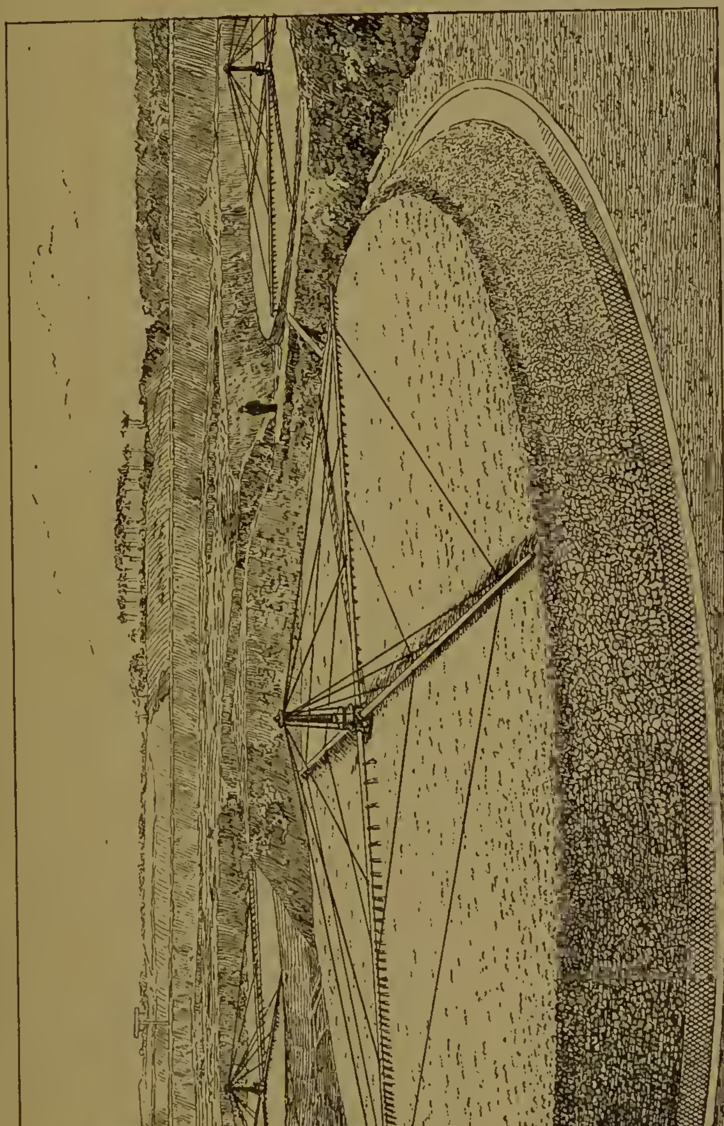


Fig. 42.—"Revolving Sprinklers."

full of fluid and solid matter, are great evils, and

may at any moment cause infection and disease. They must be very carefully constructed of brick-work, coated inside with, and having a foundation of concrete or Portland cement, so that no leakage can occur.

Periodical cleansing must be done by the local Sanitary Authority; and it is essential that these receptacles be not of large size, so as to limit, as far as possible, the danger of contamination of the surrounding soil. They must be at least 6 ft. away from the nearest house wall, and 50 ft. distant from the nearest well.

Buckets and pails used for such purposes are to be provided with closely-fitting lids. These receptacles are best made of galvanised (zinc-coated) iron, and are thus rendered air- and water-tight. Within them there may be dry earth, ashes, dry peaty soil, or "garden mould." Slop-water, &c., must not be emptied into them. Frequent removal is essential, at least once a week, preferably daily, and a new pail is then substituted.

Certain "dry-earth" and charcoal closets have been constructed. In the former half a pound of earth is mechanically precipitated from a receptacle on working the handle; in the latter three or four ounces of charcoal, which is a good deodorant. Cinder-siftings, ashes from fire-places and the kitchen are also utilised.

The earth may be obtained *as garden mould* in

agricultural districts. The harmless germs naturally present in it disinfect the excreta. Sand and gravel are not suitable. In large towns this method cannot be carried out, as it is impossible to supply and remove the material adequately. It is always a nuisance, although in the country it may be worked satisfactorily. In every such case, especially one of Infectious Disease, disinfection of excreta must be carefully attended to. To the dry earth used in the ordinary way *as little fluid as possible is to be added.* To avoid the danger of infection, as in a Typhoid case, disinfect *at once* with a strong antiseptic, such as formalin or phenol, dissolved in a minimum quantity of water. See Disinfection.

The Removal and Destruction of Refuse from Houses and Streets

This is done (1) *in the house* by its occupants and (2) *publicly* by the Sanitary Authority.

It is of the greatest importance to remove and destroy house-refuse effectually, in cases of illness particularly so. The general public are careless in this respect. No coarse material, such as combings, matches, wrapping-paper, newspaper, &c., is to be thrown down the slop- or other sinks, or the W.C. In the pantry- and housemaid's- sinks fruit-skins, vegetable-matter, &c., must find no place. If this is

done, the drains will in time be blocked and sewage will accumulate.

1. **The Dust-bin.**—It must not be a receptacle for *every* kind of rubbish. In summer the decomposition of animal matter, such as bones, fish, &c., will cause a nuisance and even ill-health. All refuse from the kitchen and scullery, whether animal or vegetable, that is likely to cause inconvenience, ought *to be burned.* This can be done in the garden, in the back-yard, or even in the kitchen itself, over a brisk fire with a good draught up the flue; kitcheners with a fire-box under the grate (for this purpose) are to be purchased. The proper time to do so is late at night, when it will cause no nuisance. All fumes, &c., will pass up the chimney. Infectious matter, dressings, &c., from the sick-room can be put into a parcel and destroyed by burning without making any exhibition to the household. The burnt material may be placed in the dust-bin. Galvanised iron receptacles are the best. They must be of a size and weight that will permit them to be easily handled, even when full, and have a tightly fitting cover, and no fluid is to be inside them. A *fixed receptacle,* such as one built of brick, is not to be used. The dust-bin is to be protected from wind and rain, the reason being obvious; the one will blow the dust about, and the other may cause the wetted contents to ooze out. It ought to be removed as far as possible from a house, to avoid

any nuisance from smell. The bottom of the dust-bin must not be below that of the ground on which it rests, and the area on which it stands must be impervious—the asphalt or cement-covered back-yard is best. The dust-bin should be cleared once a week *at least*, and the refuse removed in a well-covered "sanitary cart," and at a time when there are few people near; best at night or in the early morning, and not, as in some localities, during lunch or tea-time, when a nuisance is created.

2. The Refuse Destructor.—Rubbish is removed by the Sanitary Authority from houses and streets. It is best disposed of by burning in a specially constructed furnace known as a Destructor. Those of the latest pattern give a very great heat, up to 2000° and 3000° F. This causes rapid combustion, little smoke and smell, and the burnt residue is also small in quantity.

Specially built carts must be used to convey the material, so that there will be no escape of town-refuse into the streets, and no nuisance from smell. The covers must be close-fitting, and the body of the cart so made that semi-fluid stuff will not escape. Street refuse ought to be collected either early in the morning or late in the evening—not during the day when people are about, and there is much carriage-traffic; they might be described as "carts which pass in the night"—to the destructor.

These points are often neglected by Sanitary Authorities.

The Destructor ought to be situated in a conveniently accessible part of the town, and there should be no nuisances of smoke and smell. If situated in a residential neighbourhood the value of property and houses will diminish, because people do not like to live near an unsightly chimney constantly emitting smoke, and where dust-carts are continually passing. These also cut up the roads. In hot weather there may be a plague of flies if refuse is allowed to accumulate near the destructors. This may occur on Saturdays and Sundays when work is at a stand-still. To prevent this, all rubbish should be burned as rapidly as possible, and not be stored up. In spite of these objections the best method of dealing with refuse is by a Destructor-furnace.

If in small amount, house-refuse in the country may be buried in the ground, but it is not destroyed quickly enough, and if offensive will contaminate the soil. It is unfortunately a common practice to fill up sites for dwellings with town-refuse of the worst description, then to cover it with an insufficient layer of earth *or a thin stratum of gravel*, and finally to erect houses on this foundation, and to advertise them as "standing on a gravel soil." The result is most insanitary, because the ground sinks, the floors and walls of buildings built on

it crack, and gases from the decomposing animal-matter readily enter the house, particularly so when fires are lighted. Ill-health among the occupants is the consequence. Such foundations are known as " made soil," and are prohibited by Law.

The Healthy House

Many factors influence the healthiness or otherwise of a house. The chief are its Site, Surroundings, and general Aspect ; and in particular its Foundations, Flooring, Walls, Roof, and Fittings.

The site must be a dry one: we must consider (1) its uppermost layer, (2) the depth of the impervious (waterproof) layer below, and (3) the level of the subsoil- or "ground-water" *between the two.* The best site is a rocky one, because it cannot be water-logged or contaminated. In hot weather it is unpleasant on account of its high temperature. A gravel soil with the house at the highest point of a slope *so inclined that it carries rain-water in a direction away from the building* is excellent, *because water cannot accumulate beneath.* There must be no water-holding stratum such as clay *near the surface,* as it will retain the rain and subsoil water, and cause dampness and chill. If this impervious layer slopes rapidly away from the site and has a porous soil above it, the fluid

above it will drain off easily, and the ground will quickly dry.

Chalky soil, being porous, is not usually a damp one; the water runs through it easily. It may contain large cracks which will permit contamination of the water beneath (as already alluded to), but although a chalky soil is hot in Summer, it is otherwise healthy if there be not a stratum of clay immediately below it, *i.e.* at no great depth from the surface of the land.

Sandy soils are hot, easily contaminated, and may be marshy, especially at the foot of hills down which rain-water flows. Such loose soil is easily blown about by the wind when dry, and any disease germs in it are carried far and wide. In this way Typhoid fever was spread in South Africa during the late war; the germs infected the drinking-water and food of the troops.

Houses in deep valleys have a deficiency of sunlight and of ventilation, and the soil may be contaminated in narrow and overcrowded areas. At the top of mountains there is much wind, and the air is cold, but the conditions are healthy.

Buildings close to a hill-side are liable to suffer from the site being damp, and although screened from high winds they may have poor ventilation and little sunlight. Trees protect a house from currents of air, and are useful for removing moisture from the ground. In autumn their falling leaves

are very liable to ehoke up the rain-water pipes, which must then be eleared. Rank vegetation and damp ground were formerly supposed to cause Malarial fever. We now know this is not so, but that it is due to the bite of a speeial class of mosquito whieh breeds in sueh places.

The immediate neighbourhood of a house may be a noisy one on aecount of faetories and railways. Nuisanees may also arise from sewage-farms, slaughter-houses, and un-hygenie trades. Evil odours eause a loss of appetite and a feeling of ill health in those who are exposed to them. Windows are elosed to keep out these smells, and in eonsequenee rooms are badly ventilated, and the oecupants suffer from anæmia, headaehe, and debility.

Aspect.—This denotes geographical position, North, South, East, or West, and also the position with respeet to the sun and to prevailing winds. In this latitude we have the sun always South at midday, and the Southerly wind is generally warm and dry beeause it eomes over a eomparatively small surfaee of open sea and a large area of land (France and Spain). It is therefore an aspeet for brightness, warmth, and dryness, and a window facing South is suitable for a bedroom, espeeially that of a patient. The West and South-West aspects have the afternoon sunlight, but as the winds from that direetion sweep over the Atlantie

Ocean they are charged with moisture and bring rain. The heaviest rainfall is on the West coast of Great Britain, because the wind encounters high land there which cools it, and the moisture in the vapour-laden air is condensed into water. On the East coast the westerly winds, on arriving there from the other side, have already parted with their moisture, and in consequence the climate is drier. North winds are cold because they come from the Arctic Regions, but are less rainy because less condensation occurs. The East wind, passing over Russia and the Steppes, is notoriously cold, but in a room with this aspect we have the morning sunshine. This is not always an advantage to the patient, but with curtains and blinds the light, if it enters too early, can be modified. Of these aspects the South, South-east, and South-west are best for a sick-room as they give most light, but the counter-balancing point is that gales of wind and rain in Great Britain are chiefly South-westerly in direction.

Climate includes many factors, such as aspect, soil, nearness to the ocean, distance from the equator (Tropical, Temperate, and Arctic climates), and height above sea-level. Of these we need only now consider the last two. Places near the sea have a more equable climate, that is to say, the changes from great heat to great cold are not sudden. This is due to the fact that sea-water can retain heat

for a long time and cools slowly. Consequently it keeps the air over it fairly warm. Land, on the contrary, rapidly gets hot and as quickly cools down; hence the climate of a large continent is very variable, while that of an island is comparatively more uniform. High land is always cooler than low-lying ground; and a mountainous climate has its characteristic features.

Foundations. — These must not be laid in "made" (contaminated) soil, but on a dry, firm and porous, preferably a gravelly, stratum (p. 131).

Dampness in a house is caused in two ways: (1) By moisture rising vertically through the foundations and basement; and (2) by rain soaking horizontally through the walls.

The first is prevented by having a damp-proof layer of concrete or cement (*i.e.* one impervious to moisture) passing horizontally below the basement and under the flooring of the building throughout; to have the foundations of the outer walls built on concrete, and to have a "damp-proof course" at a height of not less than 6 in. above the surface of the ground, for every outside wall of the building (Fig. 43). The material usually employed is Cement or Asphalt having a depth of about 2 inches. Other materials may be used. Slates are too brittle; vitrified stoneware is good; and lead is excellent but expensive. By Act of Parliament *every house must have a damp-proof course.* Un-

scrupulous builders will put in worthless material, unless they are carefully watched, and a damp house is the result.

Dampness in the walls is prevented by the *impervious layer* just mentioned and by using *good*

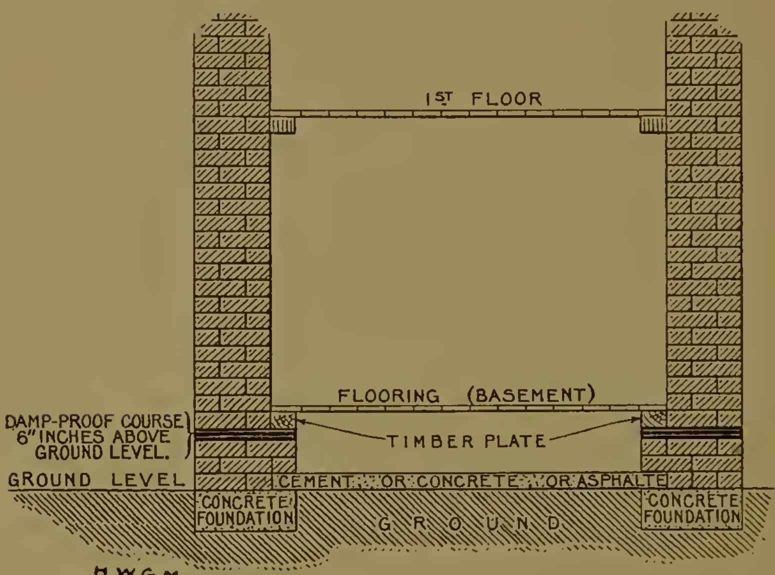


FIG. 43.—Section of Foundations, Outer Walls, Damp-proof Course, and Flooring of House.

bricks. If those on the *outer surface* of the walls are SALT-GLAZED, no moisture will penetrate. A wall can also be protected from moisture by having its internal surface covered with tiles, as is done in Hospital-wards and Operating-theatres. This also minimises the amount of dust and germs which settle there. It is because the walls are damp and wet (the bricks being of poor quality and

penetrated by holes and cracks), and the air is full of moisture, that rooms are so chilly and cold. For the same reason wall-papers peel off. It will also be noticed that in damp rooms drops of water collect on the walls—caused by warm air, as from a fire, condensing on these cold surfaces, just as one's breath does on a window-pane. Books, &c., kept in such rooms are covered with mildew, and the occupants of such premises are very likely to suffer from Rheumatic fever, "Colds," Sore-throat, and Bronchitis. Attractive-looking ("jerry-built") houses, rapidly and cheaply erected by small builders, are of this type. Doors and windows which "jam," indicate unseasoned wood and dampness of the walls; cracks appearing on the walls and in the basement are often due to sinking of the foundations in a "made-soil"; and dampness throughout the house to the employment of bad building-material. Prospective tenants should always get expert opinion before signing a lease.

The walls ought to be at least 1 ft. thick, but the Law allows 9 in. as a minimum. Thin walls render a house cold and less stable. In Scotland, where stone is largely used, the houses are warmer and more substantial in structure. Lath and plaster walls are to be condemned as too flimsy; they allow currents of air to pass through and noises to be easily heard, and there is the danger of fire.

The flooring of a house must be above the damp-proof course in the basement, and also above that in the outer walls. To prevent the boards from rotting, a current of air must pass under them, and this is done by having an *iron-grating with openings let into the outside walls* (*below the boards and above the "damp-proof course"*); or by the use of salt-glazed- "ventilating- or air-bricks" (Fig. 44). This air when cold may cause a nuisance by passing up through the floor-boards, or leaking in through cracks and crevices in the wainscot and walls of a room. In the best houses the floors are of parquet without any hollows; or "tongues" of wood, like V-shaped wedges, are inserted between the floor-boards, thus preventing the access of draughts or dust. The ceiling of rooms if of lath and plaster is easily cracked. Dust accumulates and may pass up between the floor-boards of the room above and reveal itself by brown lines along the carpet. This is only too common.

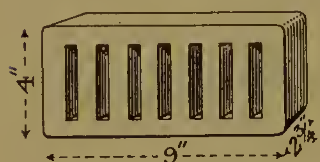


Fig. 44.—Ventilating Air-brick.

Wall-papers ought to have a smooth surface. Rough papers collect dust. Green and yellow ones may contain arsenic. Vegetable colours (if really such) are harmless. White papers soon become discoloured, especially in a soot-laden atmosphere. This also happens over fireplaces

(particularly over gas-fires), above lamp-brackets, even if electricity is the illuminant, and also along the course of hot-water pipes. This is caused by the ascending currents of hot-air (from these sources of heat) carrying with them particles of dust and soot, which are thrown against the walls and ceiling and become adherent. Wall-papers should have no raised-patterns, and are preferably of a material which can be washed. This is important in bed-rooms and nurseries, which may at any time be turned into sick-rooms. "Lincrusta," if with a *flat surface*, is useful but not cheap. Any highly-coloured or "loud" pattern is to be discouraged, and especially in a sick-room, as patients with acute disease in which there are mental symptoms or high fever are known to be affected by "large" patterns or bright colours in the wall-paper of the room, children specially so.

White-lead is to be avoided because it soon turns brown by the action of sulphuretted-hydrogen—a gas constantly given off in the breath, from sewer- and ordinary-gas and from decomposing animal and vegetable matter. It acts on lead. Zinc-white gives no such action, and ought to be used instead. All wood-work should be well dove-tailed and finely jointed to prevent it from opening-up. Cold-air currents entering near the wainscot or floor indicate bad work or faulty material.

In dwellings of limited accommodation, such as

are used by the Working-Classes, cupboards with doors ought to be freely provided. This was what Her Majesty Queen Alexandra desired when inspecting some newly-erected buildings in which there were few or none. They contribute to cleanliness, comfort, and cosiness—which are all essentials of the ideal "Home."

To avoid fire: In large buildings the wooden flooring is laid over a frame-work of iron ("joists"), the space below is filled up with concrete. This is not done in ordinary dwelling-houses, which are easily set on fire. Fire-escapes and a hose readily attachable to the nearest water-tap are desirable in every house, but the matter has little attention paid to it. (In all workshops where more than forty persons are employed, fire-escapes *must* by Law be provided.)

The best floor-covering is one which can be *easily removed* and cleaned. Polished wood (uncovered) is of course excellent hygienically, but is slippery. *Thick carpets* in "Reception-rooms," however expensive and luxurious, are un-hygienic because they collect dust and bacteria. If used they are to be pinned down only (to facilitate easy removal) and to cover only part of the floor; the rest being either polished wood (*e.g.* parquet) or "bordered" with felt or other material, *not* nailed down too firmly.

In a sick-room where there is not a polished wood floor, light brown-canvas in small strips, or

linoleum will do well. These can be removed for disinfection or burnt. Cork-carpeting is also good though somewhat expensive. It is light and easily removed, and the surface is readily washed. It has the advantage of being noiseless to the tread. The floor-space for a sick person ought to be at least 100 square feet in a private house. In General Hospitals 120 square feet are allowed, and in Infectious Hospitals from 140 to 200 square feet for each case.

Healthy people need from 15 to 20 square feet in an ordinary sitting-room to avoid over-crowding.

Heavy hangings are objectionable, and in a case of Infectious disease are to be avoided, especially woollen ones, as they collect dust and harbour germs. Lighter material can be used to keep out excessive light and to prevent a draught. If cheap, *e.g.* cotton, it can be destroyed if necessary. This material in light colours brightens a dark room, but it is very inflammable. Open gas-jets, oil-lamps, and candles are then a danger, and the electric light a safe-guard.

Blinds in the sick-room should be noiseless; Venetian-blinds are liable to rattle when carelessly drawn up, or when the wind blows against them, but they are good for ventilation, and can be turned upwards to divert the air entering by an open window towards the ceiling and away from the patient. Those of Japanese make, with narrow

strips of wood, are useful and inexpensive and have a thin covering of cotton.

The staircase of a high house must be well ventilated and lighted by windows along its course, especially in flats. In all cases the stairs ought to be *of stone* (*not wood*), to avoid danger from fire; and they must be fixed along the *outside wall* of the building, and not in the centre of it, so that not only ventilation and lighting, but also escape in case of danger can be more easily effected.

In buildings let as flats: Each floor must have water laid on and be fitted with all sanitary requirements.

The roof of every building must be well constructed, and be rain- and wind-proof. The rain-water gutters pass under the eaves, and discharge by a "rain-water shoe" over a "trapped-gully" (Fig. 22).

Every living-room *must* have a window, which will open to the air at least one-half; and its size should be at least one-tenth the size of the floor-area, and *there must also be a fireplace and chimney.* This is compulsory by Law.

The drainage, &c., must be perfect as already explained.

A warning is necessary that these ideal conditions are seldom fulfilled in houses of low rental, and even in those of higher valuation. The untutored house-seeker is easily deceived by appear-

ances,—"rustic cottages" and "bungalows" are to be regarded with suspicion.

When dwellings *are being erected*, the Engineer of the local Sanitary Authority is responsible that the building-materials, the water-supply and drains are satisfactory, and in some cases he unfortunately does not fulfil his obligations. By the Law a Medical Officer of Health is, apparently, entitled to say a house is unhealthy and unfit for occupation only after people have entered it as tenants!

The attics often have sloping ceilings which are not healthy. Dormer windows, as already indicated, may be over the open ends of ventilating-pipes, and so be dangerous.

In winter the highest rooms are cold and in summer hot, because they are placed just under a slate roof or one of sheet-iron or lead. To avoid these extreme temperatures the space below the slates is filled with felt, and the external walls are made double, and have the same material as a "padding" to keep out the cold.

Climate

The climate of any locality has a very important influence on Health. This depends on many causes, the chief of which are due to conditions in Nature which are entirely beyond our control, such as the geographical position of a country, *i.e.* near the

Equator or in the Arctic regions, the amount of rainfall and the existence of a range of mountains. It is important to bear in mind that the effects of these unalterable conditions on our bodies and on our health can, however, be modified by Hygiene and Science. Thus, by suitable clothing, extremes of heat and cold can be faced without harm; proper habits as regards eating and drinking will prevent disease in unhealthy places; and scientific engineering and drainage and well-designed buildings will render a place habitable and healthy which would otherwise be a centre of ill-health and disease.

The *chief natural causes which influence climate* are :—

1. **Distance from the Equator.**—Heat is greatest at the Equator and between it and the Tropic of Cancer (North) and the Tropic of Capricorn (South). The sun's rays there are practically perpendicular (overhead) throughout the year, and have a lesser thickness of the atmosphere to penetrate than in countries farther north or south, therefore the radiant heat is intense in all "tropical" climates. As one advances towards the Poles the rays become more slanting, and have a greater depth of air to pass through before reaching the earth, hence the temperature is cooler, and as the distance from the Equator increases so does the cold until we have an Arctic climate.

2. **The height of the land above the level of the sea.**—The air, as the height increases, is cooler because it is less dense (more rarefied) and allows the earth's heat to escape more easily into space by radiation (p. 39). In mountain peaks there is relatively less earth to absorb the sun's heat and to warm the surrounding atmosphere by conduction and convection. In tropical countries, where the heat at the foot of high mountains is great, there is snow on the summits from this cause.

3. **The distance of the land from the sea** or from any large body of water, *e.g.* the "Lakes" in America.

Water, especially sea-water, absorbs heat slowly, and also gives it off slowly when once it has been warmed. Consequently it is not liable to sudden changes of temperature, and so helps to maintain a similar condition in the air in contact with it. That is why "marine" and "insular" (island-) climates are fairly uniform in temperature. These conditions are altered when a wind blows from a colder region (as in our "East-wind"), or from a warmer zone (the South in Great Britain).

An "inland" or "continental" climate has rapid variations from heat to cold or the reverse, because it is not influenced by the sea. During sunshine the earth absorbs heat, and at night gives it off readily, and then the temperature falls.

4. **Prevailing winds.**—These may be hot; cold;

moist ("humid") according to the quantity of water-vapour present in the air; dusty or sandy (*e.g.* the Simoon). Our cold winds blow from the North and East because they come from the Arctic regions and cold dry lands respectively; from the South they are warm and dry (passing over warm countries); from the South-west and West they are fairly warm, moist, and rainy, as they travel over the sea, and the water-vapour is condensed, and descends as rain when meeting the elevated (and therefore cold) land on the West coasts of Ireland, Scotland, England, and Wales.

5. **Amount of Rainfall.**—This depends on the moisture ("humidity") present in the atmosphere and the presence of high land. As a rule great humidity accompanies a hot climate as water evaporates more quickly. Mists are formed when the atmosphere is cold enough to condense a certain amount of the water it contains, but in Nature the air, however icy it may be, retains some moisture.

6. **Character of the Soil.**—Land is greatly under the influence of the sun's heat—rocky ground warming rapidly and radiating equally so. Sandy soil contains air and gets heated less readily. It is easily contaminated, and is blown about when dry by high winds. Hence it may rapidly spread Disease.

The soil is also greatly effected by the rainfall; sandy ground absorbs water quickly, and if

there is a layer of clay beneath, water accumulates and the ground becomes wet and sodden.

Clay-soil is usually damp and cold from the water it holds. It is unsuitable for a foundation for houses, particularly for persons liable to Lung-disease and Rheumatism.

By efficient drainage it may be rendered healthy.

Marshy-ground contains pools of water and rank vegetation. These local conditions may favour the development of venomous insects such as mosquitoes, which infect persons with Malarial fever ("Ague") by biting them; or the African blood-sucking fly, which inoculates "Sleeping Sickness."

Other less important influences on the Climate of a place are:—

(*a*) The chemical composition of the air: a high percentage of oxygen (or ozone) being good and a small amount bad. The amount of Carbonic acid present in the atmosphere is considered by Dr. Hill, of the London Hospital, to be far less a matter of importance than is commonly supposed. It is, however, a convenient *index of impurity*. No doubt a low amount of oxygen, less than 18 per cent., and a comparatively high percentage of CO_2 both contribute to lower health. Substances added to the air, such as volcanic vapours and vegetable spores, *e.g.* "Hay Fever," also influence climatic conditions.

(*b*) The pressure or weight of the air under

natural conditions. It is judged by the barometer, which indicates it on a vertical scale or on a dial. The column of mercury rises with an increase of pressure, and falls when this diminishes. The former occurs in bright, dry, and frosty weather; the latter when it is going to be wet and stormy.

(*c*) Humidity (moisture) of the air has been referred to already. In this country about 70 per cent. is considered to be most suitable, that is to say 30 degrees less than complete saturation, which is estimated at 100 degrees. In hot weather an atmosphere charged with water-vapour prevents the evaporation of perspiration from the skin (which would cool the body) and thus renders one hot and uncomfortable. These conditions cause the climate to be "relaxing," *i.e.* one gets easily tired and feels disinclined for either muscular- or brain-work, and is readily depressed. On the contrary a cool or cold atmosphere fairly dry (70 degrees of moisture) is "bracing" and acts like a "tonic," because one feels fit for both kinds of work, is able to endure fatigue better and is brighter in spirits.

(*d*) Sunlight in abundance *without excessive heat* improves the climate of a place and stimulates growth and activity generally.

The instruments, in addition to barometers and thermometers, used in Observatories to determine the conditions of the atmosphere and the

state of the weather are those to register the force and velocity of the wind, the amount of moisture in the air, the duration of sunshine, the quantity of rain or snow which has fallen in the locality, and the electrical condition of the atmosphere. A trained Staff of Observers records the results at the Meteorological Office in London, and the "weather-forecasts" are made from information by telegram from all parts of Great Britain and from abroad. These are published daily in the newspapers, and predict the *probable state of the weather* for the next twenty-four hours.

Climate of the British Isles

Along the sea-coast in Summer the climate is of the "marine" or "insular" type, and is cool with a moderate amount of moisture.

During winter the South-west and South coasts of this country are rendered much warmer than they would otherwise be by the Gulf Stream, an ocean-current of warm water which travels across the Atlantic Ocean from the Gulf of Mexico (between North and South America) towards Ireland and England, and warms the air during winter. There are also warm and moist winds coming from the South-west and South which also raise the temperature along these coasts.

Speaking generally, it may be said that the West

Coast is warm and moist, the East cold and dry. In England the S.W. Coast as far as Sidmouth has a warm winter climate for these latitudes. From Hastings to Bournemouth, in the Isle of Wight and in the Channel Islands (Guernsey and Jersey, &c.) the climate in Winter is fairly dry and warm. In Summer it is "relaxing." Along the S.E. coast-line, including Dover and Folkestone, the conditions resemble those of the East Coast.

In Summer the climate is bracing from Nairn in Scotland to St. Margaret's Bay (East Coast), and the same is true from Dover to Southsea.

Ardrossan, Oban and Rothesay in Scotland have cool summers.

In Ireland the climate is mild and equable from Bray to Glengariff, and is suitable for Lung-cases.

Winter-resorts. In England: the Isle of Wight (especially the South side), Hastings, Boscombe, Bournemouth, Sidmouth, Exmouth, Falmouth, Dawlish, Teignmouth, Torquay, and Penzance have a fairly equable and mild climate.

In Scotland: Rothesay is an excellent Winter-resort.

In Ireland: Glengariff and Queenstown.

The driest parts of England are on the East Coast: The neighbourhood of the Wash, the mouths of the Humber and the Thames; and the wettest: Seathwaite, the Stye, and the Lake District.

In Scotland the neighbourhood of Loch Quoich has the greatest rainfall, and the mouths of the Forth and Tay, and the Moray Firth, the least.

In Ireland the Killybegs and Macgillycuddy's Reeks have the most, and Dublin the least rain.

In Wales the most rain falls at Snowdon, the least at Rhyl.

In this country the warmest time of the year is most fatal to young children—the last week in July and the first fortnight in August. "Summer diarrhœa" is then most prevalent, and is due to contamination of foods by flies and by germs which are most active in hot weather. Decomposition of milk, &c., occurs from the same cause. December and January—the coldest months of the year—have the highest death-rate among the aged, pneumonia being the usual cause of this mortality.

CHAPTER VIII

INFECTION

INFECTION causes disease by a poison entering the body, which may be affected locally or constitutionally.

If caused by *actual contact* with the diseased or contaminated surface it is known as CONTAGION; the word is not usually used now in this restricted sense, but as conveying the same meaning as "Infection." INOCULATION means that the poisonous material has entered the body through some absorptive surface, abrasion or opening in the skin or mucous membrane. It may be inhaled or swallowed.

The causes of Disease are germs, known also as "Bacteria," "Bacilli," or "Microbes." They are of a *vegetable* nature and are exceedingly small. To see them clearly the most powerful microscopes are needed. They are stained by certain dyes in a characteristic manner, and by this means many of them can be easily recognised. They are also identified by their peculiar modes of growth, their shapes and other differences, Some will grow in

the presence of Oxygen, others will not. All require a certain degree of warmth and moisture to develop well. One species—particularly those which form SPORES—will resist a very high temperature (even above that of boiling water) for a short time without being killed, and others will be uninjured by cold below freezing-point. At these extremes of heat and cold they remain inactive, but can resume growth and be infectious on returning to more favourable conditions. Prolonged or frequently-repeated boiling will however kill all forms, *excessive heat is their worst enemy.*

The germ of every disease has not been discovered. It is probable some are so very minute that our microscopes do not render them visible. It may also be that some diseases are caused entirely by a fluid poison and not by a germ of any shape or kind. In nearly every case microbes can be artificially grown in various substances, such as milk, gelatine, broth, and other specially-prepared material. They can be recognised by their peculiar mode of grouping, colour, or development in these media.

Infection is conveyed by air, by water, soil, excreta, clothing, food, &c., and also by *animals and insects.* Particles of saliva containing millions of virulent germs can carry infection over a wide area in a room, and they have been found in the air of a lecture-room at a distance of at least seventy feet

from the speaker. By coughing and sneezing bacteria are conveyed still farther.

The general Public shows an amount of ignorance and carelessness in the subject of infection which is as remarkable as it is discreditable. *It will be a Nurse's duty to impart clearer knowledge.* Let us consider the most common causes of the spread of Infectious diseases and the simplest methods of prevention.

People suffering from a communicable disease will enter public places and conveyances such as omnibuses and railway-carriages, or they will do so after coming directly from an infectious person without taking any precautions. In this way Scarlet fever, Small-pox, Measles, Whooping-cough, Mumps, and other diseases are disseminated through ignorance and neglect.

By entering rooms, such as apartments at the sea-side, which have been previously occupied by an infectious case *people are very liable to contract disease. It is necessary always to inquire, when engaging lodgings anywhere, if there has been any sick person in them recently, and if so what the disease was, and whether, if infectious, the premises have been properly disinfected.* This information may be obtained from the Medical Officer of Health of the place.

The Public Health Law is very severe in this matter, and its regulations will be referred to subsequently.

Infected clothing spreads disease, *e.g.* that worn by people who have come from the patient's room. All hairy and woollen materials are dangerous carriers of germs. Cotton and linen are far less so. That is a reason for nurses wearing these materials for outer garments; they can also be more easily washed than wool, and, if necessary, destroyed at less cost. Operating surgeons cover their clothing, hands, hair, and faces to avoid the risk of infecting the patient by any germs which are present there, or are carried by the breath.

People in the name of Charity send their worn-out, and it may be infectious, clothing, to "jumble sales," or to be otherwise disposed of. Pawnbrokers' shops, auction-sales, and places where second-hand articles are sold are centres of contagion all over the country. Bedding, furniture, pillows and cushions frequently carry the germs of disease. The material (known to the trade as "flock") used for stuffing mattresses, "feather-beds," and pillows has been proved to be of the filthiest kind. It is usually prepared from old clothes and worn-out carpets full of dirt, which have been torn-up by machinery and have never been disinfected or cleaned. It is only quite recently that the better class of upholsterers have paid attention to the matter, and have taken due precautions against infection.

Circulating libraries distribute books which have been returned without being disinfected by persons

who have used them when suffering from an infectious illness.

Toys which have similarly done duty in a sick-room are sent to Hospitals and to the poor. Small children will put things into their mouths, as nurses and mothers are well aware, and Diphtheria may be so conveyed.

People use drinking-vessels, spoons, and forks which have served for others and have not been disinfected. This should be obviated in all hotels and restaurants by immersing these articles in boiling water, and then wiping them in a *clean* cloth.

Mothers and those attending on children will often thoughtlessly put infected spoons, rubber teats, &c., into the child's mouth, having first introduced them into their own, or after having picked them up from the floor! There is such a thing as "*auto-infection*"—that is to say a person can infect himself from a spot on his own body where the disease is at first strictly localised. How easy it is then to infect another person, even one's own child, through want of care!

The uncleanly habits of children must be corrected as early as possible, and *with kindness, not severity.* The exchange of half-eaten sweets; drinking out of the same cup; the repulsive way of "cleaning" a slate (now happily prevented by the use of writing-paper in most schools); putting pencils and pen-holders into the mouth; turning over the pages of

a book after licking the finger: these un-hygienic methods carry infection and are unfortunately not unfamiliar to those of an older growth who ought to know better! Such apparently trivial details need attention at school—“as the twig is bent so is the tree inclined.”

Indiscriminate expectoration is a fertile cause of the spread of Tubercle. This habit must be prohibited in every public place and public conveyance. At home suitable receptacles must be provided where needed for patients, and in infectious cases a disinfecting lotion must also be added (see page 177). Flasks for expectoration are obtainable at all Druggists’ shops.

Hair-dressers and barbers spread infection by using brushes, combs, and scissors which harbour germs or parasites. The very idea is repulsive, and all this can be prevented by disinfecting in boiling water or by steam as is done in hospitals. There is a Bye-law on this subject which applies to barbers.

Let us now briefly consider the diseases conveyed by animals and insects to Man. Our domestic animals, the dog and cat, are frequently spreaders of disease.

Hydrophobia can be inoculated by the bite of both if they have developed it. Hydatid disease which forms tumours in Man is communicated by the eggs of a Tape-worm which is found in the dog.

The cat easily contracts Diphtheria, and will readily spread it. These animals should never be fed from plates and cups used by people, and the deplorable habit of allowing a dog to lick one's hand and face hardly needs comment. By it Hydatid disease, Hydrophobia and other infection can be conveyed.

The coats of these animals will also readily carry the germs of disease, and they must never enter an infectious room, *e.g.* one in which there are cases of Ringworm, Scabies, or any contagious disease of the hair or skin.

The cow suffers badly from Tuberculosis; the membrane (or pleura) covering the lungs, these organs themselves, and the glands are early diseased; the muscles and *udder* get infected later. The infection can be conveyed to Man if such meat is eaten without being thoroughly well cooked, and the milk is drunk without previously boiling it.

The pig is very liable to be attacked with this disease, and by Law the entire carcase of every such animal (however slightly infected by Tubercle) must be completely destroyed.

Some outbreaks of Scarlet fever have been attributed to cows and not to human infection.

The milk of infected goats, if drunk un-boiled, will cause Mediterranean- or Malta-fever.

The pig also suffers from ANTHRAX or "Malignant

Pustule," and so also do the sheep and the cow, though less frequently.

The horse is affected with Glanders, and it is conveyed to Man by the secretions of the nostrils and mouth, and is a fatal disease.

Fowls can be infected with Tubercle, and infection can be contracted by people feeding on them. Danger is averted by thorough boiling or cooking of the flesh.

It is well known that rats are active agents in spreading Plague.

Insects too are agents for the dissemination of disease. The bug can be infected with Plague, and transmits it. Malaria and Yellow fever are inoculated by the bite of different kinds of mosquito. The bites of ticks which infect dogs and cattle similarly produce a special kind of fever in Man.

Sleeping-sickness is caused by the bite of a blood-sucking fly (GLOSSINA PALPALIS).

Let us next consider what legal steps are taken in Great Britain and Ireland to prevent the spread of Infection.

In England and Wales and in Ireland there are the Infectious Diseases Notification Act, and the Infectious Diseases Prevention Act. In Scotland both these are combined in one Act of Parliament known as the Public Health (Scotland) Act. The London Public Health Act also includes similar measures for the Metropolis, which has special

regulations apart from the rest of England. As these Laws are very much the same it will be sufficient to mention the most important practical points.

The Diseases which MUST BE NOTIFIED TO THE MEDICAL OFFICER OF HEALTH of a district are:—

Scarlet Fever.
Typhoid Fever.
Typhus Fever.
Puerperal Fever.
Relapsing Fever.
"Continued Fever."
Diphtheria (and so-called "Membranous Croup")
Erysipelas.
Small-pox.
Cholera.
Plague (when prevalent).

Cerebro-Spinal- and Posterior Basic Meningitis, Ophthalmia Neonatorum, and Chicken-pox (notifiable temporarily in London).

In *some* places Tubercle of the Lungs[1] ("Consumption") and PNEUMONIA have been added to the above list of diseases to be compulsorily notified.

Measles and Whooping Cough though very infectious are not included (although certain Towns have

[1] Tubercule of the lung in Poor-law institutions and those under District Medical Officers is notifiable; and also among in- and out-patients at Hospitals or similar institutions (in England and Wales).

specially added them) in the list because the number of persons suffering from them at the same time is too great to be convenient for Notification, and there is also the question of expense, because half-a-crown is paid to the Medical Adviser for every "compulsory" case he notifies, which he is bound to do if he is attending it. If not, this *must be done* as soon as possible by the patient's nearest relative who is present; *or by any other person in attendance,* so that a nurse may be obliged to give the information. Those who omit to do this can be summoned and fined by the Court.

For the PREVENTION OF THE SPREAD OF INFECTION :—

The Medical Officer of Health can *compulsorily remove* an infectious case from any house, if he considers there is a danger of other people getting the disease owing to unsuitable accommodation, overcrowding, &c. He does so under an order of a Justice of the Peace (England and Ireland) or a Sheriff (Scotland).

The patient is removed with special precautions to a suitable hospital for treatment.

Children can be stopped from coming to school, or the school may be ordered to be closed by the Local Sanitary Authority. Before children from an *infected house* can return to school, they must have a certificate from a medical practitioner or from the Medical Officer of Health stating that the house

has been disinfected and that they are free from infection. If the pupil has had the disease, a certificate that he is not infectious is necessary also. Persons can be summoned by the Medical Officer of Health, and fines be inflicted for the following :—

(1) People wilfully *exposing themselves or others under their care* (without taking proper precautions) in *any public place* (street, shop, hotel, conveyance, &c.), or entering any public carriage without previous notice to the owner, driver, &c. Any conveyance so infected must be disinfected before being used again.

(2) Any one exposing, selling, or exposing for sale infected bedding, clothing, rags, &c., to the danger of the public.

(3) Persons letting infectious apartments, houses, and buildings before they have been disinfected.

(4) Any one giving a false answer when asked about the existence of any contagious disease which has occurred on the premises within the previous six weeks. For this a heavy fine *or imprisonment for one month* may be the penalty. This is important to those who let lodgings at "Health-resorts" and at the sea-side.

(5) In Scotland and in Ireland special provision is made in the Acts against sending to school any child who has within the previous *three months* suffered from an infectious disease.

(6) The retention of the body of a person who has died from an infectious disease in a house (if likely to be injurious to the public health) is prohibited. After a limited time it can be removed by an order from the Medical Officer of Health and buried.

(7) The sale of milk likely to be contaminated by persons who are infected, or by meat from diseased animals, &c. This will be referred to under "Food."

Other precautions against the *spread of Epidemic Diseases* are legally enforced under the Public Health Acts for each part of the Kingdom, and these authorise :—

(1) House-to-house visitation and inspection by the Medical Officer of Health or his Staff when necessity arises.

(2) Regulations for the accommodation of patients, of suspicious cases of illness, and of people who have been in contact with them. These are isolated in separate rooms, and those believed to be free from disease or infection are in a few days allowed to leave after disinfection. Due precautions are taken to ascertain their future address.

(3) The removal and disposal of the dead.

(4) The examination of every infected or suspicious ship which enters a port, and its disinfection if necessary.

The Sanitary Staff can enter any premises on obtaining a Justice's order to do so. The usual time in England and Ireland is between 9 A.M. and 6 P.M., and in Scotland between 6 A.M. and 9 P.M. In a matter of urgency this can be done at any hour of the day or night. There is a penalty against wilfully obstructing any duly authorised Official.

The Supreme Authority under Parliament is the Local Government Board, and there is a separate one for England, Scotland, and Ireland. The President of the Board in London is a Cabinet Minister, and under him there is a special Medical Staff.

Under these Boards are the County Councils and Borough Councils formed by the Mayor and Aldermen in England and Ireland; by Provost and Bailies in Scotland. The Medical Officer of Health of each place is under the authority of these Boards and represents them Officially. In smaller districts there are Local Authorities under the above, known as the District or Parish Councils.

For preventing the extension of all Infectious Diseases it is essential to know four things:—

(1) The probable date and length of exposure to infection.

(2) The period of Incubation of the disease in question.

(3) The time after infection in which definite

symptoms of disease, such as rash, &c., usually make their appearance.

(4) The period which generally elapses before a patient is free from infection, and is able to go amongst the healthy without risk of spreading the disease.

It is also very important to know, if possible, how the infection was contracted.

Diseases have special modes of spreading, and our knowledge, unfortunately, is still imperfect in this matter.

Germs (like seeds planted in the soil) grow *after infecting* the body, and for a certain time do so without showing any signs of their activity either to the person attacked or to those observing him. Diagnosis during this "STAGE OF INCUBATION" is, therefore, practically impossible. Persons under suspicion of having taken the infection are termed "SUSPECTS," and those who have been within the area of contagion are "CONTACTS"; the latter may never be attacked themselves by the disease but may convey infection to others. Both these individuals ought to be "isolated"—that is to say, kept, with suitable precautions, apart from all who are susceptible to attack.

This interval of isolation is known as the period of QUARANTINE, and covers the time during which the uncertainty exists as to whether the suspected person will or will not develop the disease.

The germs of some diseases are rapid in their growth, and this period of "latency" (hidden activity) is then a short one and the diagnostic signs of the disorder soon appear—Diphtheria for example. Others progress slowly, and there is a long Incubation-period before we can be sure that infection has taken place—as in Typhoid fever and Mumps. By special bacteriological and chemical tests we are able in many diseases to make an early diagnosis, and our knowledge on this point is daily extending. Consequently, early measures for the prevention of the spread of infection and for the safety of the patient can be adopted. There are many other conditions which must also be considered: some persons are naturally insusceptible to the disease in question, and so will not "take it" at any time; others may have had it before and so are most unlikely to be reinfected; others, again, may have been successfully vaccinated, or specially treated bacteriologically, so as to be "immune" (un-attackable). On the other hand, persons in weak health or in un-hygienic surroundings are very likely to be victims; especially if the disease-poison is a virulent one; or they may have been particularly exposed to infection. They will probably develop it more quickly and suffer more severely.

Certain diseases are liable to attack people more than once, *e.g.* Erysipelas, Influenza.

In all the acute Infectious Diseases attended with fever the entire course may be conveniently divided into six variable periods: "Infection"; "Incubation"; "Invasion" (development of Symptoms often with an *Eruption* or Rash); "Advance" (continuation of the fully-developed disease); "Decline" or "Defervescence" (when the termination of the symptoms is approaching); and ending either in "Convalescence" (preceding a return to a state of health) or death.

In the preventive treatment of Infectious Diseases the following results are attainable:—

(1) Infection may be prevented.

(2) The disease may be checked even in those already infected.

(3) The attack, if not prevented, may be rendered a mild one, and a fatal termination probably avoided.

Vaccination fulfils all these conditions because it is a preventive against infection from Small-pox. Even if a person is already infected, vaccination within the first four days of the Incubation period will probably stop the disease. If this time-limit is slightly exceeded the attack will most probably be a mild one, and non-fatal.

Hydrophobia usually takes a few weeks to develop, and the treatment of the late Monsieur Pasteur of Paris, *if properly carried out before any symptoms appear*, will prevent the disease developing.

Diphtheria has a short incubation period, and

therefore ANTI-TOXINE must be used early to neutralise the poison. If the patient already has the disease, early treatment is curative. All will appreciate the importance of:—

(1) *Knowing the length of the period of incubation of all infectious diseases;*

(2) Realising that the longer this interval the greater is the chance of preventive measures being effective;

(3) Commencing treatment as early as possible, *i.e.* before the germs of poison have invaded the whole body, and before symptoms have shown themselves.

TABLE OF INFECTIOUS DISEASES (FEVERS)

Disease.	Age.	When Most Prevalent.	Mode of Infection.	Incubation Period.	Symptoms on Invasion, Advance, &c.	
Diphtheria (La Diphtherite).	All ages. Nurses very liable, and children (2 to 8 years especially).	October to December, Epidemics.	Air, Clothing, Room, Saliva, Nasal Discharges, &c., *Infected milk*, Cat, Toys, Bacillus Diphtheriæ.	Usually 2 days; it may be 2 to 10.	Greyish white membrane—second day of illness. On tonsil, uvula, &c. Advance: fever, great debility, *weak heart*.	Sore throat may resemble Scarlet fever. Great danger from weakness of heart on exertion. Only free from infection when germs are absent from throat, &c. (Bacteriological examination necessary).
Pneumonia (La Pneumonie).	Any age, chiefly old people.	Spring and Winter.	Bacillus Pneumoniæ.	Short: 2 to 3 days.	Early rigor. Lung symptoms.	Infectious during attack.
Scarlet Fever or Scarlatina (La Fievre Scarlatine).	All ages, specially children 4 to 7 years.	November and December, Epidemics.	Direct Contagion, Breath, Skin, Clothes, Books. Milk specially (cow may probably get the disease). Discharges from ears and nose of patient are very infectious. Special germ unknown. Epidemics vary in intensity.	Usually 2 to 4 days (1 to 7).	Rash on second day of illness on upper part of chest, front and sides of neck, Sore throat. (In children vomiting is an early symptom.) Fever later—finally desquamation ("skinning").	Resembles Small-pox, Measles, Diphtheria, Sore throat. Is one of the most fatal diseases of children. Free from infection after six weeks from commencement of disease, and when discharges from ears, nose, &c., and desquamation have ceased, probably after six weeks of commencement of illness. (Bacteriological examination necessary.)
Erysipelas (L'Eresipele).	Adults over 40. Surgical and Post Partum cases. Children.	Spring.	Contagion. Inoculation wounds. Germ of Erysipelas.	Usually 3 days (3 to 7).	Redness on second day of illness on inner angle of eye, internal ear, &c. "Blebs," swelling of face, high fever, delirium, &c. Desquamation later.	Dangerous for old people and chronic alcoholics, and in puerperal cases. Free from infection when skin has finished peeling.
Measles (Ordinary) (La Rougeole).	Young children chiefly.	June and December. Epidemics differ in severity.	Specially infectious before and during rash. Neighbourhood of patient, Air, Clothes. Discharges from nose, mouth, skin.	10 to 12 days.	Rash on fourth day of illness. Usually first on forehead, at roots of hair and behind ears. "Koplik's spots" (inside cheeks).	Resembles *German Measles*, Small-pox, Scarlet fever. Infected child should be isolated. Causes many deaths, and predisposes to "*Consumption*" *of the lungs later*. Free from infection after all rash, &c., has disappeared, probably three weeks after commencement of disease if attack is mild.
Small-pox (La Petite Verole).	Any age if unvaccinated.	Spring and Autumn, Epidemics.	Patients are infectious before rash appears. Air, Clothing, Skin, &c. Germ uncertain.	Usually 12 days.	Rash on third day of illness, usually first on face. Previously, intense backache. Headache, vomiting or earlier red "blush." Later, secondary fever, "blebs," pustules, desquamation, &c.	Resembles Measles, Scarlet fever. Free from infection after all scabs and desquamation have disappeared.
Typhus Fever (La Fievre Typhus).	All ages.	Winter Epidemics severe but infrequent.	Very infectious, especially near patient and during second week of illness. Bedding, Clothing, Furniture long retain poison. Germ not known. Especially among filthy surroundings. Overcrowding. Nurses are very liable to infection.	Usually 12 days (2 to 14).	Rash ("Mulberry") on fifth day of illness. Usually on abdomen, chest, backs of hands. *Face and neck usually free.* Symptoms rapidly developed: rigors, vomiting, flushed face and eyes. Disease usually terminates with *a crisis*.	One of the most infectious diseases. Now seldom seen except amongst very poor and dirty people. Deaths among children few. Free from infection after cessation of fever, probably six weeks after commencement of disease.
Typhoid Fever (La Fievre Typhoide).	Chiefly young male adults.	October, November, December.	Water and Milk, Oysters, Cockles, Vegetables, Defective drains, &c., Flies, Excreta. Bacillus Typhosus.	About 14 days (5 to 23).	Rash at end of first week: *few* small rose-pink spots on abdomen chest. Later intestinal symptoms. Characteristic temperature chart. Lysis or crisis at end of fever.	Resembles Influenza. Later appearance of rash distinguishes it from Scarlet fever, Small-pox, and Typhus fever. Relapses may occur. Convalescence slow. Free from infection probably after six weeks. Bacteriological examination necessary.
Chicken-pox or Varicella (La Petite Verole Volante).	Children specially.	Spring, Autumn, Epidemics.	Germ unknown. Air, Clothing, Contacts.	Usually 14 days.	Rash (seen first day of illness on chest, back, &c.). Slight fever, successive crops, each lasting 3 to 4 days.	Free from infection after skin has become normal. Probably two weeks from commencement of illness.
German Measles (Rotheln) (La Roseole Epidemique.	Children or adults.	March to June.	Immediate neighbourhood of patient, infectious Clothing, &c.	Usually 16 to 18 days.	Rash on second or third day of illness. Pink spots on face first. Enlarged glands in neck. Sore throat. Slight fever—3 days.	Free from infection when skin is normal, probably after three weeks from commencement of illness.

Nurses should make it clear to Parents, &c., that mildness of the attack in one person *does not lessen the chances of another taking the infection*, or of having a *virulent type of the disease*.

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CHAPTER IX

DISINFECTION

INFECTION is caused by the action of living germs or of poisons derived from them. Disinfection is the process by which these are destroyed or rendered permanently harmless.

"Deodorants" remove or conceal bad smells and are quite useless to prevent infection. They give a false idea of security, and people relying on them are led into danger.

Charcoal, because it readily absorbs the gases of putrefaction, is a deodorant, and so are scents. *Weak* solutions and vapours of aromatic oils and resins, such as eucalyptus and camphor, are ineffective, although, *when concentrated, they prevent* the activity of microbes, and may even destroy them.

An *Antiseptic* is a substance which stops the growth and infective properties of germs. It may do so only temporarily, and when this action has ceased they may, under suitable conditions, grow again and be infectious.

A *Disinfectant is a germicide* and destroys the vitality and dangerous properties of germs once and

for all. Most antiseptics when used of sufficient strength are disinfectants; and all the latter (if not diluted too greatly) have an antiseptic action.

In Nature the oxygen of the air, sunlight, great heat, and the action of germs against each other, are important agents in causing disinfection. Radium rays, and those known as the ultra-violet rays of the spectrum, also destroy germs and parasites (such as those of Ringworm); and have curative effects on certain diseases of the skin and on TUMOURS which are believed to be due to the action of bacteria. Our knowledge in this subject is increasing steadily.

Disinfectants may be of various kinds:

(1) *Heat is the best* and simplest of all, and may be used in the form of (*a*) fire; (*b*) *dry heat* such as hot air (as in baking); or (*c*) *moist heat, e.g.* boiling water or steam—the last two being preferable to hot air.

(2) *Chemical Disinfectants* are used as solutions or gases. The former are suitable for the hands, articles of clothing, excreta, furniture, &c., and also for spraying the walls of an infected room. Gases, set free in a closed apartment, are excellent for general disinfection, and for fumigating books, &c., which cannot be washed.

1. Disinfection by Heat.—This can be done: (1) *In the house,* by simple methods, when small articles are to be disinfected. (2) *Outside the house,* by

Sanitary Authorities employing special apparatus for the treatment of bulky material such as bedding, clothing, &c.

In the house.—*Fire* is the disinfectant always procurable. Infected rags, &c., are to be burned at once, and also articles of clothing which are of little value. Nothing should be sent out of the house unless it has already been, or is on its way to be, disinfected. In the latter case every precaution against the spread of infection must be taken.

"*Baking*" destroys all parasites and insects, but hot air is not very effective against bacteria unless the temperature is a very high one, and this will injure leather and clothing, and may slightly char these materials. Hot air *does not penetrate* deeply into thick articles such as blankets, pillows, and mattresses; and therefore *does not kill germs which are below the surface.* Small articles can be disinfected in a baking oven, or in a tin box near a hot fire. It must not be forgotten that they may be charred or destroyed if the heat is too great, and there may be changes of colour and texture. White flannel, blankets, &c., become yellow by heating; they and leather articles such as boots, gloves, &c., shrink considerably. A dry heat of 225° F. should not be exceeded, otherwise clothing will be damaged. Steam under pressure is far more efficient and more rapid.

Boiling Water is an excellent means of disinfec-

tion; handkerchiefs, pillow-cases, &c., if placed in a tub containing water kept at a temperature of 212° F. (boiling-point), and thoroughly soaked in it for twenty or thirty minutes, will be free of infection. It is not necessary to add a disinfecting-solution subsequently. After wringing them out they should be dried before a fire or in the open air. Woollen articles, blankets, &c., shrink after boiling, or after exposure to dry heat. *They must not be boiled.* If white they become discoloured. Blood-stains *must first be washed off in cold water* (preferably one containing a disinfectant)—if this be not done the application of heat will cause woollen articles to be permanently stained.

Disinfection by steam is best carried out by special apparatus, and this is effected by the Sanitary Authorities at their Disinfecting-Stations. Private firms also have such apparatus available to the Public.

In the first case, the Medical Officer of Health gives the order, and a special Collecting-van calls at the house for the infected articles. These are entered on a list, a copy of which is left; and the clothing, &c., is placed in tightly-fitting bags and conveyed to the disinfecting-station. Every care is taken to avoid infection being spread when collecting and removing these articles. They are, after disinfection, placed in *another* aseptic cart, and returned to the house. The list is checked, and

compensation is given for any articles which may have been damaged or destroyed.

Steam Disinfecting-machines are of various patterns, and they have the following advantages:—

1. A high temperature can be used without scorching or injuring the goods (with few exceptions).

2. Bulky and thick articles, such as pillows, mattresses, blankets, &c., can be disinfected throughout, because steam *under pressure* penetrates to all parts.

3. The action is rapid.

4. The cost is not great.

Steam disinfectors may be divided into two classes:—

1. Those of "high-pressure." Steam from the boiler is forced into a tightly-closed iron box from which it cannot escape. The pressure of the steam steadily rises, and is indicated on a dial connected with disinfecting chamber, and may be of 10, 15, or 20 pounds, and the temperature also increases above that of boiling-point (which is 212° F.) to about 240° F. or 260° F. Dry- or fire-heat (that is heat without moisture) will char or burn clothing at these temperatures, but steam does not do so.

2. The "low-pressure" machines do not raise the temperature of the steam above boiling-point.

It remains at 212° F., or may rise a little above that point when the water in the boiler contains certain salts which are added. The steam is *not confined under pressure,* but flows into and out of the apparatus in a current.

In some cases a disinfectant, such as Formalin-vapour, is added to the steam, but this is not

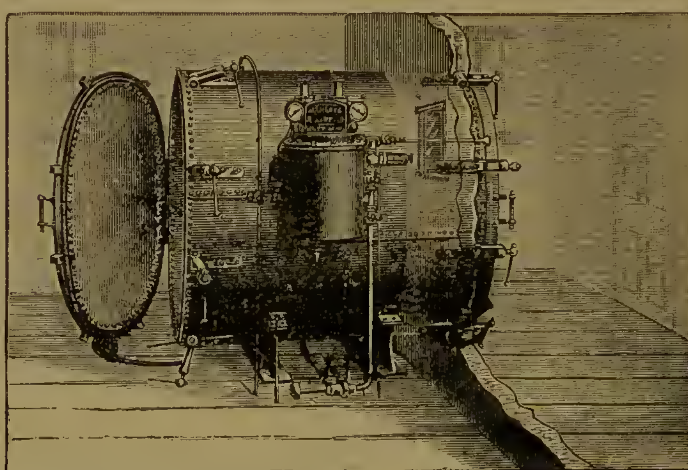

Fig. 45.—High-Pressure Steam Disinfector.

necessary. It makes disinfection more certain and also more rapid.

Among the best known high-pressure machines are the Washington-Lyon, Alliott & Paton's (Fig. 45), and the "Equifex." The method commonly employed in large establishments is as follows:—

A disinfector is placed in a separate building, which is divided into two rooms by a brick-wall through which the disinfection-chamber passes, half

of it being in one room and half in the other. There is no other communication between these compartments. One part receives the infected, the other the disinfected articles *after they have passed through the steam-chamber.* Infection therefore cannot be spread. The door of the apparatus in the first

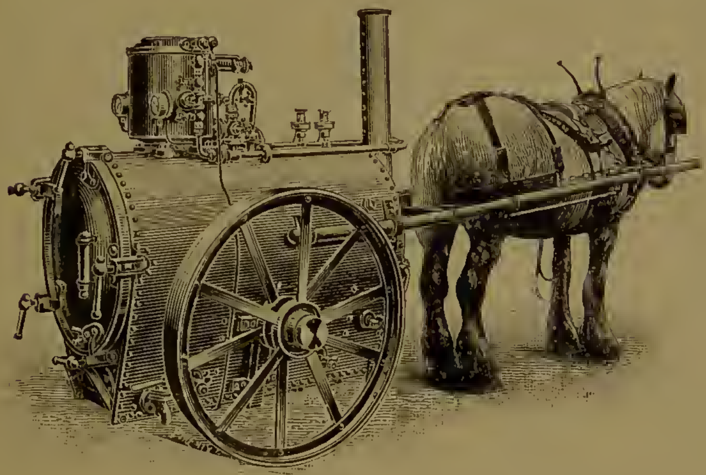

Fig. 46.—Portable Steam Disinfector with Boiler and Furnace combined.

room is opened, that in the other apartment being tightly shut, and the infected articles are placed inside the chamber; a "carrier" holds them in position. The steam-chamber is screwed up, and steam is allowed to enter it from a boiler under high-pressure. In some machines before this is done all air is sucked out of the apparatus by a special pump, and the steam, rushing into a "vacuum," penetrates into the deepest and smallest

crevices of the material. When the steam-pressure has risen to the desired point it is kept there for from fifteen to twenty minutes. It is then allowed to fall, and when the chamber has cooled down sufficiently the apparatus is opened in the second room and the disinfected articles are removed and taken back to the house (Fig. 45).

Low-pressure machines are the Reck, and others. As the steam is not under high pressure, less heat and less coal are needed, and therefore the cost is less. They take about the same time for disinfecting articles, but are less suitable for bulky material.

Light machines (high or low pressure) are mounted on wheels, and can be transported from place to place as required without difficulty (Fig. 46).

Chemical Disinfectants

Solutions and Sprays.—These may be used as lotions or gases (fumes). It is important that they should fulfil the following conditions: (*a*) Be *germicides,* or disease-germ destroyers; (*b*) act fairly quickly, and penetrate clothing, walls, &c., deeply; (*c*) be easily dissolved in water so as not to form any sediment; (*d*) be non-poisonous if absorbed through the skin, wounds, &c., or swallowed or inhaled; (*e*) be not strong irritants or corrosives; (*f*) have a distinctive colour, or have a taste or

smell which is not offensive, yet is sufficiently apparent, so that their presence may be easily recognised.

Liquids are more effective than gases because they soak into a substance; gases act more superficially, and in consequence may not reach the deeply-seated germs.

The quantity of the disinfectant used should be double the volume or weight of the fluid or solid (*e.g.* excreta) to be disinfected.

As an example of a powerful disinfectant, which unfortunately does not fulfil all these conditions, is Perchloride of Mercury or Corrosive Sublimate. A very poisonous solution is one part in a thousand of water (*i.e.* well diluted); it has no colour, taste, or smell, and so may easily be mistaken for ordinary drinking-water with fatal results. Solutions of this salt, therefore, have a dye and a strongly-smelling liquid added to them to prevent mistake.

Many disinfectants can be purchased in the form of Tabloids of known strength. Of the various chemical disinfectants, solutions of carbolic acid of 1 in 20 (one part of liquefied Phenol to 19 of water) and 1 in 40 are well known to all Nurses.

The germ of Tubercle (Consumption) is destroyed in a few minutes by a 1 in 20 solution of carbolic acid. It is therefore useful for disinfecting sputum in such cases, and is better for this purpose than perchloride of mercury ("sublimate").

A sheet constantly wetted with this or other antiseptic fluid is hung up before the door of the patient's room to prevent the spread of infection. This plan is not very efficient, because it does not arrest the germs. Mercuric lotion, as already mentioned, has the disadvantage of being very poisonous. It is used in strengths of 1 in 500, 1 in 1000, and 1 in 2000. It is more effective if a little hydrochloric acid is added to a 1 in 200 solution, especially for disinfecting excreta, as in Typhoid Fever. It hardens the skin and dulls metallic instruments, and these are disadvantages.

Permanganate of potassium or Condy's fluid is not a suitable disinfectant. It must be in a very strong solution to be of use, and rapidly undergoes change which renders it of little value. It acts by the oxygen in it combining with the infectious material; but much of the gas escapes and has no effect.

One of the best is Formaldehyde in the strength of 1 or 2 parts in 100. It is used as a lotion for disinfecting clothing, &c., as a dry vapour for acting on books, and as a spray on the walls of a room, &c. It has the disadvantage of irritating the eyes and nose if inhaled, and its vapour acts on iron and brass. These should be smeared with oil (*e.g.* vaseline) or lard before disinfecting a room. "Formalin" contains about 40 parts of Formal-

DEHYDE in 60 of water, 1 of FORMALIN to 39 of water forms a 1 per cent. solution of FORMALDEHYDE and 1 to 19 a 2 per cent. solution. Both are efficient. In weak solutions or vapours (2 in 100) it rapidly destroys germs in clothing, &c., and is comparatively non-poisonous to man. For spraying walls 4 ounces of FORMALIN, 5 ounces of glycerine in 1 gallon (4 quarts) of water are efficacious; the glycerine prevents rapid drying and so causes the solution to soak in.

Of late many excellent disinfectants have been *prepared from coal-tar*, and these act quickly on bacteria, and are not otherwise poisonous. They have the disadvantage in many cases of forming a precipitate on the addition of water (becoming "milky"), but recent tests seem to show that these minute oily particles are an advantage, because they have a more rapid action on germs.

These various solutions have been compared with carbolic acid and the results obtained (by *The Lancet*) have been satisfactory, the most efficient being in order: COOK'S COFECANT, SANITAS BACTOX, SANITAS OKOL, CYLLIN; MCDOUGALL'S "M.O.H." FLUID, KEROL, IZAL, CYLLIN and some others, including LYSOL.

Most of them are active in solutions from 2 to 5 per cent. (2 parts in 100) for disinfecting the hands; for infected clothing, instruments, &c., double this strength is safest.

Gases and Vapours.—These are mostly used for disinfecting rooms and articles which cannot be washed or steamed. Clothing, sheets, curtains, &c., should be treated by steam or soaked in an antiseptic. Leather goods, such as boots, gloves, &c., are spoilt completely by steam or hot air and so ought to be washed in a disinfectant, or sprayed with it, or fumed in a dry gas (as formalin) which is not hot.

Furniture is best washed with an antiseptic, such as Phenol (1 in 40), as the germs do not penetrate, but are on the surface. In non-virulent Diseases washing with soap and water is enough.

Sulphur fumes are not to be recommended. They are produced by burning powdered "roll sulphur" in a metal pan which is placed over a vessel containing water (to avoid danger of fire). The windows of the room, and all cracks and apertures must be previously closed by means of strips of paper gummed over them. All hangings, carpets, bedclothing and pillows must be removed for disinfection by steam as they will not be penetrated by the fumes. The Sulphur is moistened with methylated spirit, and is set fire to in the centre of the room, which is then closed up, and the door completely sealed outside. Two pounds of sulphur are used for a room of 1000 cubic feet capacity.

Another plan is to let *liquid* sulphur di-oxide (a

very irritating gas sold in special tins) escape into the room. After several hours (better after 24) the apartment is opened and thoroughly ventilated.

There are two serious objections against the use of Sulphur fumes for disinfection. They are not powerful enough to destroy germs readily, and they do not penetrate sufficiently into the pores of any material—they act very superficially. Consequently many germs remain unaffected. The sulphurous smell is retained for some time in a room and is disagreeable. It can be removed by spraying with "Toilet-vinegar."

A far more efficient disinfectant is Formaldehyde generated and discharged into the room as a vapour by means of a special apparatus. Of these the best known are Trillat's, Kuhn's lamp, the Trenner-Lee and Ligner's. The room is sealed up in the usual way (the "register" also is closed), and the fumes are discharged by the apparatus being placed in the room itself, or outside it. In the latter case the fumes are blown in by a tube passing through the keyhole which is finally sealed up. After several hours the apartment is opened and thoroughly ventilated.

For room-disinfection Formalin tablets are prepared, and can be used in an Alformant Vaporiser, or Alformant Lamp. From 5 to 20 tablets are used for every 1000 cubic feet of space, according to the strength required.

By mixing potassium permanganate and formalin heat is given off and FORMALDEHYDE gas escapes. A circular metal tray 7 inches in diameter and 4 inches deep has about 4½ ounces of POTASSIUM PERMANGANATE in crystals placed in it, and on these about half a pint of FORMALIN is poured. The reaction is completed in about 5 minutes. For simplicity and rapidity of action this method has been preferred in this country by Dr. Kenwood and in America by Mr. Base.

A simple method is to hang up two large bed-sheets in a room at an angle of about 45 degrees to each other, these are damped with water and sprayed with FORMALIN, using from half a pint to a pint according to the size of the room. A uniform amount of gas is given off for a long time.

A Home-made Disinfector.—Small articles of clothing can be (loosely) placed in a tin box with a tightly-fitting cover and containing lint or cotton-wool soaked in formalin.

AMYLOFORM, GLUTAL, PROTEAL and LYSOFORM are disinfectants which all contain FORMALDEHYDE, and are used for clothing and surgical instruments. The last named is a soap which mixes well with water, and is comparatively non-poisonous.

CHAPTER X

FOOD—MILK, ETC.

THE function of food is to maintain the growth, repair, and natural conditions of the body.

The adult needs variations in diet; a continuance of the same kind of food soon causes a distaste for it, and a loss of appetite.

Milk is the most suitable and the most easily assimilated of all foods, especially for children. It contains all the necessary materials for supporting life admirably combined. It serves both as a solid as well as a liquid diet. People are apt to forget that it forms in the stomach a solid, being there curdled by the action of the stomach-juice which contains hydrochloric acid in weak solution.

It is essential that the milk be *hygienically pure.* To children it must be given in proper quantities, and in proportions suitable to their age, state of health, and physical condition. Mother's milk is the best food for the infant, and it ought to be given unless there be a deficiency in quantity or quality, or if there may be some disease present such as Tuberculosis which renders it unsuitable for the child.

Cow's milk is usually substituted, and for the very young infant, unless great care is taken, it may be most indigestible. Human milk contains a slightly larger proportion of "lactose" (commonly known as milk-sugar), and also more water than that contained in cow's milk. It is also more digestible because it forms smaller and more easily digested curds in the stomach.

The milk of the ass, and next to it mare's milk, most closely approach human milk in composition and in digestibility. These are in suitable cases substituted for it, and can be obtained from certain Dairy Companies who keep these animals. The cost is somewhat high. It is most convenient to use cow's milk, and to dilute it according to the age of the child.

Every perfect food must contain, besides water, the following :—

1. **Proteids.**—These always contain nitrogen, and are present in both animal and vegetable foods, *e.g.* meat, eggs, milk, bread, potatoes, and all vegetables. Proteids are changed into peptones in the stomach during digestion. When this is defective, pre-peptonised food is given. Proteid food furnishes energy to the body, nutrition and warmth.

2. **Fats,** which are in greater quantity in animal-food but are also found in vegetables. They contain no nitrogen.

3. **Starches and Sugars.**—The starches occur in

farinaceous foods such as bread, biscuits, &c., and are non-nitrogenous. They are changed in the mouth into a sugar (known as "grape-sugar"). This is caused by a ferment present in the saliva of adults, and of children *above the age of six months.* It is not found in those below that age, and in consequence it is obvious why very young babies who are given bread and biscuits, arrowroot and cornflour, suffer from indigestion and diarrhœa, and get thinner and weaker. They are unable to digest such material. It acts as an irritant to the stomach and intestine, and if not replaced by suitable diet will cause the practical starvation of a child and its death. Both sugars and starches are transformed into fat in the body. They are therefore avoided as much as possible by those who wish to reduce their "stoutness." All three are "heat-producers," and help to keep the body warm.

The purest cow's milk usually contains a little less than 88 parts of water in 100 of milk, and slightly more than 4 parts of fat. Because there is more fat in it than in human milk, very young children cannot take it without dilution.

4. **Salts,** less than 1 per cent.—of which sodium chloride is the chief.

"Humanised-milk" is prepared from cow's milk as follows:—

1. The whole of the cream is removed by skimming.

2. The milk is then divided into two equal portions.

3. To one portion rennet is added, which converts the milk into curds and whey.

4. To the other portion of milk this whey is added and also the cream which was first removed, and these are mixed together.

The milk so prepared more elosely resembles human milk, and when fresh is easily digested.

It has the following disadvantages:—

(*a*) It will not keep long.

(*b*) After a time it forms large clots.

(*c*) If used for a child above 6 or 7 months of age there is not enough nutrition in the milk.

(*d*) If long-continued (for several months) without any other diet, the child might develop symptoms of Scurvy or Rickets (Dr. Cheadle).

Condensed milk is usually prepared by boiling down the original milk to about a third of its volume and then adding sugar. This is then sealed up in tins when hot, so as to destroy all germs. To be nutritious the milk so used must be whole milk, *i.e.* not skimmed or "separated." There are many brands which contain practically no fat or cream at all, because this has been fraudulently removed. Such are worthless. It is against the Law to sell any condensed milk so treated unless it bears a label stating it is "skimmed" or machine-skimmed milk, with the letters in type easily read. Nurses must

be careful to look for this notice when using condensed milk, and such should be avoided. Good condensed milk for a child during the first month of birth should be in the proportion of 1 part of milk to 20 parts of water, or even 24 if there are symptoms of indigestion. The dilution is to be gradually decreased to 1 of milk and 9 of water in the third month. Condensed milk long continued may cause a condition of Scurvy or Rickets. Some brands of milk contain no added sugar, and are therefore suitable.

The opened tin must be kept in a *cool and aseptic place*, and the lid be shut down always and covered with a clean cloth (to keep out dust, flies and germs); not near decomposing or strongly smelling articles (such as fish, &c.), nor near a sink. Once infected, condensed milk favours the development of bacteria.

"Patent" foods are to be avoided. They usually contain starch or other substances unsuitable for young children. Some have little or no fat and are non-nutritious; others contain too much sugar. Certain widely-advertised brands are used indiscriminately by the Public with bad results. Water used for diluting milk, unless known to be pure, ought to be boiled first as a precaution.

Cow's milk may be diluted as follows:—

At birth 1 of milk to 3 of water; after the first week, milk 1 part to 2 of water; or 1 of milk,

1 of barley-water and 1 of ordinary (boiled) water during the next three weeks. Undiluted cow's milk (*i.e.* "whole milk") should not be given until the seventh month at the earliest, and in those with weak digestion not until after the ninth.

Infants fed on Mother's milk are the healthiest. Those reared on artificial foods and "hand-fed" are more liable to disease, and particularly to "Summer diarrhœa," which is very fatal among the poor.

It is necessary for every professional Nurse to know how Cow's milk gets contaminated and adulterated. The first is caused through ignorance and carelessness, the second is purposely done to make a profit. Stringent Laws exist against the contamination and adulteration of milk, but they are not severe enough to stop the frauds which are committed daily.

Contamination occurs (1) from the dirty or diseased condition of the cow itself; (2) from the stall in which the cow is kept, the place where it is milked and the *manner in which this is done;* (3) from filthy conditions and habits among the milkers and all others who handle and convey the milk, use dirty pails, and unhygienic milk-carts; (4) from the state in which the premises such as Dairies, Milk-shops, &c., are kept; (5) from contamination in the house itself after the milk has been delivered and where it is drunk. We shall consider these briefly in detail.

(1) The animal often has its tail, udder, and legs covered with filth. During the process of milking particles of dirt may be dropped into the pail containing the milk. By Law the cow must be well washed before it is milked, and the tail is to be kept out of the way (tied up).

(2) The floor must be clean, and the stall kept as hygienic as possible. It must be well-ventilated and well-lighted, with a sufficient free space (800 cubic feet) for each animal. Milking should be done on a hard and clean surface, not on a sodden one, and not in the stall.

Disease.—The great danger is Tubercle ("Consumption"), which commences in the lungs, and affects the udder before long, and when this occurs the milk contains the bacilli of this disease, and infection is certain among those who drink the milk *unboiled*.

The animal may also suffer from other Diseases such as Foot and Mouth Disease (communicable to Man), and possibly from Scarlet Fever, the germs of which from a Patient can certainly be conveyed by milk, and the disease spread in this way.

(3) The milkers should be thoroughly taught their business under hygienic conditions. This is done in the best establishments; those who are ignorant and unclean wear dirty clothing which may readily infect the milk, and have disgust-

ing habits, and in this way Tubercle and other diseases can be disseminated. By Law all milkers must wash their hands, and wear a clean apron before milking, and every animal must be well groomed and clean. *Every person* who handles the milk, the cans, or keeps a dairy or a milk-shop, or *conveys the milk* must have his name and address registered by the local Sanitary Authority. The cows and the attendant are constantly examined by the Medical Officer of Health and the Veterinary Surgeon, and so every case of suspicion or of disease is supervised, kept apart from the rest, and treated immediately. Nevertheless numbers of unscrupulous persons escape detection (in small farms and milk-shops) and gallons of Tubercle-infected milk are drunk in London and throughout the country. It is safest therefore to boil the milk always. Milk-pails, &c., must (by Law) be scalded by steam or boiled in water before use, and always be kept thoroughly cleansed. Offenders are prosecuted and fined.

(4) All places in which the milk is stored must be clean, and the rooms containing the vessels must not be occupied as a sleeping apartment or used for any other purpose than for storing milk, and no W.C. must be in the same room. All cases of infectious disease among those who handle the milk, cans, convey or sell milk must be notified at once to the Sanitary Authorities. Every dairy, Cow-shed, and milk-shop must be notified to them

and be licensed and registered, and be under their control both in town and in country districts.

Unfortunately, unclean people will always be so unless they are constantly supervised, or severely punished when detected, hence a hygienic training is of the greatest importance.

(5) Persons through ignorance contaminate milk in their own houses. If put near a sink or closet, germs and foul gases soon obtain access to it. If left uncovered, particularly in warm weather, the same thing occurs. Milk whether fresh or *condensed*, and any other animal-food, must always be kept in a *cool and clean* place, and always be protected from dust, flies, and exhalations. This is unfortunately seldom done efficiently. It applies with greater importance to milk intended for children, who are so easily susceptible to infection.

No food ought to be kept in a sick-room unless this be a necessity and it is wanted for the patient only. It must be in a cool place and well protected. No diet solid or liquid must be partaken of in the patient's room by any one attending a case of infectious Disease, and this is a wise precaution at all times. Jugs with tightly-fitting lids or covered with a clean towel are useful for storing milk. In hot weather it is best to keep the vessels surrounded with ice, after boiling the milk.

The diseases which can be spread from diseased persons by infecting the milk are: Typhoid Fever,

Scarlet Fever, Diphtheria, Cholera (usually by the addition of water containing the bacilli), and Tuberculosis. Milk being an excellent medium for germs to grow in, is more liable than water to transmit such infection.

Cow's milk if unskimmed must by Law contain at least 3 parts of fat in 100. Usually milk from a good cow contains more than this—nearly 4 per cent. The best milk and cream producers are cows from Jersey and Guernsey; Norfolk and Suffolk; Ayrshire in Scotland, and Kerry in Ireland. Unscrupulous dealers skim off the fat and sell the milk without stating it has been "skimmed" or "separated." If detected (and Sanitary Inspectors are constantly taking samples for chemical analysis) they are fined, but the penalty inflicted is usually not severe enough. Any one buying milk can have it tested by a Public Analyst or by an expert for a small fee, but only the Sanitary Authority can demand a sample Officially for the detection of fraud. A purchaser can always report his suspicions to the Authorities, and they will take the matter up without charging him any fee.

"Separated" milk is skimmed by a machine and *contains practically no fat at all.* It is worthless as a food, and children drinking it will not be nourished at all. In doubtful cases when buying milk one ought to stipulate that it be "pure" and "sweet," that it contain at least 3 per cent. of fat ("whole

milk"), and that no *colouring matter* or any *preservative* has been added to it.

More fat is present in "evening" than in "morning-milk." Most is found in October and November, and least in May and June. "Fore-milk" contains less than "the strippings" (last portion drawn).

"Colostrum" (milk after calving) contains blood- and pus-corpuscles and much albumen. Its sale is illegal.

A common practice is the removal of cream and fat and the addition of water.

Fat and cream are lighter than milk, and therefore float on the surface. When they are removed by skimming or "separating," the denser (or heavier) fluid is left. To escape this being detected the fraudulent dealer adds as much water as will render it sufficiently dilute to resemble milk from which no fat has been taken.

By chemical analysis the actual amount of fat in good milk, unadulterated, is known to be *at least* 3 per cent. (3 parts in 100). If the suspected milk is analysed, and found to contain less, it is known either that the fat has been purposely removed or that the milk has been watered. Usually both are done. In the latter case there will still be a a certain though diminished amount of fat.

The lactometer is a very useful instrument for testing milk; it is used in a similar manner to

the urinometer. It is allowed to float in the milk, which ought to be warmed to a temperature of 60° F., and the reading on the scale of the instrument is taken at the level of the surface of the fluid in the usual way.

In a normal sample this is usually 1032 (specific gravity). After the removal of the fat the scale-reading rises to 1034, and the dealer, by adding water, brings it back to the first figure. But the absence of fat at once indicates the fraud, and legal proceedings can be taken against him. It is a well-known practice to get a Guernsey or Jersey cow, which gives a very large proportion of fat, and to skim off all excess above the standard, or to add water to the milk till the fat falls to the legal minimum standard of 3 per cent.

Nearly all milk is artificially coloured by Anatto, Turmeric, Saffron, or by some dilute ANILINE DYE specially made for this purpose. Pure Cow's milk is practically *opaque white*, and if "rich" (containing much fat) has only a faintly yellow tint. The dealers purposely tint it yellow to deceive their customers. People in large cities will not buy "white milk," because they do not recognise it, and hence milkmen excuse themselves for using a colouring-agent. If the public insisted on it being white and pure, this object would soon be attained. All nurses should educate those who are ignorant of this matter. Pure milk is not

of a bluish tinge, and is not a transparent liquid. A simple test is to put a drop on a clean piece of blotting-paper, and to notice how quickly a circle of water forms round it; this occurs rapidly if the milk has been diluted with water, and much more slowly if it is pure and contains the proper amount of fat.

Pure milk is *very slightly* acid or very slightly alkaline. If the alkalinity is great (turning litmus-paper very blue) some soda has probably been added. Any sediment, such as pus, or blood corpuscles, and particles of dirt, &c., will form at the bottom on standing for an hour or two. This sediment is examined under the microscope and easily recognised.

Cream will float up to the top of the milk after 24 hours, and most of it in about 12. If placed in a straight glass vessel (resembling those used for clinical tests in the wards) the amount of cream can be estimated. The sample of milk should be fresh and be well stirred before being tested. The cream in pure milk should be at least one-tenth of the whole column in depth.

The colouring-matters mentioned are harmless, but are intended to deceive, and are contrary to the Law. They can easily be detected by chemical tests.

When milk becomes "soured" it forms curds and whey. This can be caused by adding rennet

or an acid, and it is also produced by the action of certain germs which cause a fermentative process. It is also believed that a thunderstorm will "turn" milk, but in all probability it is due to the access of these germs, which grow well in warm weather.

Milk well boiled and carefully *sealed up* in a germ-free bottle without the access of contaminated air will keep sweet for months. This is how "Condensed" milk is preserved without the addition of any antiseptics.

Preservatives such as Boracic Acid, Salicylic Acid, and Formalin are added by dealers to prevent decomposition. The Law is now more strict in preventing this being done. The first two are liable to cause indigestion, irritation of the bowels, and severe illness in young children. They may be taking large quantities of these because the farmer, the purveyor, and the milk-salesman may each of them have added a little without the knowledge of the others. Formalin, well diluted, is also used, and is added in sufficiently small quantity to prevent decomposition and to avoid its detection by taste or smell. By warming the milk in a narrow tube or glass the peculiar odour of formalin can be detected. Its presence can also be proved (even if in very small amount) by chemical tests. Boracic acid if in sufficient amount gives a green colour to the flame

of the spirit-lamp when a platinum wire (fitted to a glass rod) wetted with the milk is held in it.

Mothers in general and nurses (of the "old school") have an objection to boiled milk. It may in some children cause constipation to a slight degree; if scorched the taste is unpleasant. If long continued in very young children it may cause a liability to Rickets by destroying a certain ferment present in fresh milk.

The disadvantages are insignificant compared with the safety obtained by boiling. The addition of from 5 to 15 grains of BICARBONATE OF SODA to the quart of milk (according to the child's age), with a little sugar of milk, prevents a constipating tendency.

FIG. 47.—"Pasteurisation" of Milk.

Milk sterilisers of various patterns are sold. "Pasteurisation" *destroys the most dangerous germs*, and is done by placing the milk in a jug and immersing this vessel in a tin basin or a saucepan containing water which has to be heated to boiling-point (212° F.), and kept at that temperature for twenty minutes at least. Care should be taken that the water on boiling does not enter the jug.

The milk is to be stirred so that it may be uniformly heated. It does not reach boiling-point but keeps a little below it. It is therefore more acceptable to some.

Feeding-bottles must be of a pattern which permits them to be easily cleaned; they should open at both ends and preferably be "boat-shaped." No rubber tubes are to be used because they cannot be thoroughly cleansed. The teat should fit the end of the bottle and be washed both before and after use. Air must be allowed to enter the bottle as the milk is drawn out, otherwise it will not flow at all. Some bottles have a rubber air-valve at the opposite end to the teat, and it may easily get out of order. A baby newly born cannot hold so much as one ounce of milk in its stomach, but only a little over ʒvj (about 6 teaspoonfuls.) After the fourth week it can contain ℥ij. Unqualified nurses do not appear to realise the small size of the organ, and seem to think it can retain and digest the contents of a feeding-bottle amounting to about half a pint! The excess is usually vomited, and the irritation may cause serious intestinal troubles.

Infantile Mortality.—It is at its highest during the first month after birth, and diminishes in the second and third. The chief causes are: ignorance, carelessness, and inexperience of those in charge of children. It occurs chiefly among the poor, but is

also found in the upper classes of Society where responsibility is shirked. The death-rate is known to be so appalling that it has been termed "the murder of the Innocents." More recently it has diminished owing to the spread of Education and a wider knowledge of Hygiene. The Children's Act of Parliament which came into operation in 1909 is most important for safeguarding the lives of Infants (see Appendix).

Meat contains nitrogen; as a food it builds up and repairs the tissues of the body, produces energy and warmth. A vegetable diet can, to a certain extent, replace meat, but to remain in good health "vegetarians" take milk, butter, and eggs (which are "animal foods"), because these supply those essential constituents which are either absent, or present in too small a quantity in a purely vegetable diet to be of any utility.

Some meats and poultry, such as pork, veal, and duck, are indigestible and are unsuitable for those who have feeble powers of assimilation. Beef, mutton, and chicken are more easily tolerated. Much depends on the age of the animal and on the manner in which the flesh is prepared. "Underdone" meat is more indigestible than that which is well cooked.

"High-game" or decomposed flesh of any kind is always liable to cause illness, and may contain a virulent poison. By cooking it well, the germs in it

are destroyed by heat, but poisonous secretions are not so destroyed, and may produce serious consequences.

Examination of Meat

The way to judge meat is by Sight, Smell, Touch, and Taste. Uncooked meat should not be dark red or purple in colour, or have any greenish tinge. It is not to be very moist. The fat ought to be whitish or slightly yellow. Too yellow a fat indicates jaundice. In *healthy* Jersey and Guernsey cows the fat is always very yellow, and this is a peculiarity.

There must be no odour of decomposition, and this is best detected near a bone. Any suspicious smell of medicine or of antiseptics indicates that the animal has been "dosed" or the flesh been tampered with. All such meat must be absolutely condemned.

To the touch, the meat must be firm and elastic,—neither sodden nor tough in consistence. This can be tested by inserting a pointed skewer and feeling if it penetrates steadily and fairly easily—any sudden decrease of resistance indicates softening and decomposition in the meat; and the presence of a bad odour on the skewer, when withdrawn, confirms this suspicion into a certainty.

The bad quality of meat, poultry, or game is detected on eating, but some palates appreciate the

flavour of game and venison that have been "hung"—this causes the flesh to be less tough because it has softened by decomposition. Slightly *warming* the uncooked meat brings out the odour more; and cooking renders it and the taste less noticeable.

The diseases which can be conveyed by diseased meat and milk, &c., have already been considered (pp. 158, 189).

No food is to be kept exposed to sewer-air, or near any sink where germs naturally abound. The pantry ought to be cool in Summer, well shaded from the sun and not too near the kitchen-fire. Its *best aspects* are North or East, which are the coldest in these latitudes, as already explained. All foods, including milk, bread, butter, jams, vegetables, and fruit, ought to be protected from flies and dust. The former are dangerous germ-carriers, and contaminate everything they settle on, after coming from a tainted spot.

Fish.—"White" fish, *e.g.* sole, whiting, plaice, and cod, are more digestible than those of a richer (more oily) nature, such as salmon, turbot, and in particular, mackerel. The last-named often causes indigestion in "delicate-stomachs."

Boiled fish are more easily digested than fried. During convalescence from a serious illness after a milk diet, or milk-and-egg, boiled "white" fish is generally more suitable than boiled chicken. Every case must of course be considered on its own merits.

Shell-fish, with the exception of oysters, are far more indigestible than all others. Lobster and crab are notorious causes of indigestion, especially when taken with sauces and "dressing." To the sufferer from indigestion these are "anathema," to the early convalescent from gastric ulcer or Typhoid fever (really Typhoid *ulcer*) they may mean death.

Shrimps, periwinkles and cockles are also indigestible, and if they contain germs of disease, *e.g.* Typhoid, they are infectious.

Examination of Fish

Fish can be judged by smell (obviously), sight, and touch.

Those of the oily kind—pilchards, eels, herring, and mackerel, &c.—decompose sooner. When "salted" this is prevented for a time.

The eyes of the fish deeply sunk-in, dull, and discoloured; and the gills not red but pale and dirty-looking, indicate decomposition. To avoid suspicion unscrupulous salesmen will colour the gills red, and remove the eyes.

By touch: stale fish feels "limp," the tail hangs down, and the flesh will easily pit between the fingers which will meet if there is much decomposition. The scales also come off easily.

Vegetables and fruit contain nitrogen in small amount. As flour, oatmeal, potatoes, &c., they

form a digestible and nutritious diet and are "fattening."

The principal constituent of all vegetables is starch, which in the body is turned into sugar ("grape-sugar") and forms fat. Oatmeal-porridge and milk form an excellent diet, though somewhat constipating when long continued.

Bread and weak tea are a bad substitute for it among the poorer classes.

Bread contains starch chiefly, and is made from wheat and oatmeal. The grain of wheat has an outer coating of bran, which in whole-meal bread is retained in the flour. The "germ," which is part of the grain, consists of nitrogenous matter (protein), starch, and vegetable fat, and is nutritious. In "white bread" the bran and "germ" are commonly removed, and in "STANDARDIZED BREAD" it is desired that 80 per cent. of wheat, the "germ," and the semolina must be present. Millers usually remove the latter, and some bleach the flour by nitrous acid fumes or other means. This renders the bread indigestible and unpalatable, and should not be permitted. The whiteness of the loaf is then no proof of its purity.

TEST: Wheaten flour has a yellow colouring matter soluble in petrol. *Un*bleached flour mixed with petrol gives the latter a yellow colour; bleached flour leaves petrol quite white. Half-an-ounce of flour and two fluid ounces of petrol are sufficient,

and the test must not be done near a flame, as the vapour is explosive.

FRUITS contain much sugar and vegetable acids which are useful for preventing scurvy. Eaten fresh and ripe and in moderation they assist in maintaining health both in grown-up children and adults.

"Lime-juice" (which by Law must contain no sugar when sold as such) is an excellent remedy for this disease, and so are fresh fruits, and a vegetable diet.

ADULTERATION

Dealers unfortunately colour vegetables (when sold in bottles) with copper and other dyes to impart a green colour. In this way peas, beans, capers, pickled cabbage, &c., are treated by fraudulent firms and cases of Copper poisoning have occurred, and the metal has been detected chemically. Solutions of copper cause brown stains on a bright steel knife.

Starchy food such as arrowroot, wheaten flour, &c., is also sold after fraudulent mixing with potato (cheaper) starch. This can be easily detected under the microscope.

Even "fresh" fruit is manipulated by dealers, and in some cases the "bloom" of grapes is artificially produced, and also the glossy condition of apples and pears by methods which if truly reported are as disgusting as insanitary. Cheap jams and marmalade

are to be avoided beeause other fruits or skins are fraudulently substituted, deeomposing fruit is employed, and even flavouring material; seeds and dyes are added whieh are purposely intended to deceive purehasers. The sugar *or other sweetening material* may be also most impure in sueh eases.

Where evidenee is strong, all these ought to be brought to the notice of the Medieal Offieer of Health of the plaee, and he will be able to take legal proceedings under the Food and Drugs Aets, and those regulating the sale of Milk, Butter, &e. The aggrieved individual is put to no expense, as the Sanitary Authority is responsible.

Margarine prepared from beef and mutton fat is substituted for butter fraudulently. By the Law, when offered for sale, or when sold, it must be distinctly labelled " Margarine."

Beverages

Water is the eommonest natural drink. It is suitable at every age, the one neeessary eondition being its purity.

Tea, eoffee, and eoeoa have one property in eommon — all three are valuable *non-alcoholic stimulants* and restoratives of the nervous system, if properly used. Coeoa has the additional recommendation of being to a eertain extent a food, as it stimulates the museles speeially.

Tea and coffee contain tannin, which is an astringent, and if present in large amount, as in tea which has been soaked or "stewed" too long, will cause indigestion and loss of appetite.

Tea is to be prepared by using *boiling* water and infusing for no longer than five minutes. After this the leaves are to be removed, otherwise more tannin will be extracted. Special tea-pots and "infusers" are made for the purpose.

Tea is adulterated by adding other leaves (easily detected microscopically), and it is also a trick of the trade to dry tea-leaves which have already been used ("drawn"), and to sell them again. This is punishable by Law.

Tea or coffee taken too strong, or in large amount, cause nervousness and sleeplessness, especially if drunk late at night.

Coffee is usually adulterated with chicory ("wild endive"). A simple *test* is to lightly sprinkle a sample of the ground substance on the surface of a glass of water. The coffee grains will remain floating on the top for some minutes, the chicory granules sink to the bottom almost at once, and leave yellow streaks as they descend. A microscopical examination is best. Strong coffee is useful as a stimulant in Opium or Morphia poisoning —given by the mouth; or injected as an enema (one pint).

Alcohol,

Like tea and coffee, is a stimulant of the heart but acts more quickly. It is therefore useful as a medicine in cases of collapse from heart failure. It is dangerous in injuries to the head; after a "stroke" (rupture of a blood-vessel in the brain); and in cases of ulcer of the stomach, particularly so in strong doses. The reason is that as it stimulates the heart the blood-pressure is increased, and more bleeding is likely to follow. Unfortunately people turn to alcohol for treating every case of faintness and of disease. Alcohol is not a food for the body. It does not build up its tissues or repair them. If long continued, in large or frequent doses, even if they do not cause symptoms of "alcoholism," the nervous and muscular systems degenerate, both brain- and muscle-power gradually deteriorate, and there is in consequence a greater liability to disease. The liver usually becomes affected. When taken alcohol *temporarily* dilates the blood-vessels, including those on the surface of the skin, and makes the heart beat more rapidly; this causes a feeling of warmth. If given in large doses the temperature *falls*, and the body is colder than before owing to its action as a poison. Brandy, whisky, and gin contain about fifty parts of alcohol in one hundred of the liquid; rum contains more.

Wines, made from the grape, contain much less (from 8 to 18 per cent.), port and sherry are the strongest. The Public has an idea that "red wines are good for the blood"—probably on account of their colour. This is absolutely incorrect.

Filtration through charcoal-powder often renders them colourless.

Ale and stout contain from 3 to 6 parts of alcohol in 100. Stout usually is stronger than ale and is more indigestible. It is supposed to be a good tonic, useful for digestion, and *necessary* for "nursing-mothers." The reverse is the case, and this ought to be plainly stated by the Nurse. Alcohol is absolutely unnecessary for the healthy individual, and is to be considered first as a medicinal agent for the sick; next as a luxury and finally as the most potent cause of disease, of crime, and of death which blots our Civilization! Its results are seen in every grade of Society, in every Hospital, Work-house, and Prison. Its effects are evident not only in the person primarily concerned, but also in those around him, and in his descendants.

It is most important whenever alcohol is ordered by a Physician or administered by a Nurse to carefully consider the following points:—(1) in what form the alcohol is to be taken; (2) at what time of the day and how it is to be given, *e.g.* diluted or not; (3) the quantity at each dose; (4)

at what date the treatment is to be commenced, and *when it ought to cease.* This last precaution is often omitted, and the Physician is quoted as having ordered alcohol as a routine drink for the future. One cannot be too careful!

CHAPTER XI

PERSONAL HYGIENE

We now pass from the eonsideration of the General Health of the Publie to that of the Individual. The state of the skin and hair needs constant attention. The daily-bath is advisable at all ages, but has often to be replaeed by one given onee or twiee a week.

The temperature of the water ought to be taken in all eases of siekness by the bath-thermometer, and ranges as follows:—

Tepid bath, from 85° to 92° F.; the warm bath, between 92° and 100° F.; the hot bath from 100° to 106° F.; and the very hot one, from 106° to 112° F.

Young ehildren and old persons are very suseeptible to extremes of temperature. For the former the eold bath is dangerous in wintry weather, and the idea that it will "harden" them is untenable. The aged are liable to faint in a hot bath from weakness of the heart—a risk whieh all trained nurses are aware of.

Very eold and very hot baths are only to be given under medieal adviee. For infants the tem-

perature of the water ought not to exceed 100° F. The most suitable period for bathing them is the evening before bed-time, for the following reasons: (1) There is less liability to chill, as the child should not go out of the room again; (2) the body is probably most in need then of being cleansed, after the dust and heat, &c., of the day; (3) the warm bath at night promotes sleep.

A super-fatted soap (procurable from the best manufacturers) ought to be used. Alkaline, highly-coloured, and scented varieties are to be avoided as they irritate the skin. Those which are largely advertised as possessing antiseptic qualities of a superior kind will not realise what is expected of them.

Every child must have a bed or cot to itself, and is never to share the bed with the mother or nurse. This is prohibited by Law (Children's Act). Pillows and mattresses should be "stuffed" with clean material (p. 155). Feather-beds are unhygienic. A firm mattress on springs and well covered with one or two blankets is most suitable, and the bedclothes are to be *as warm and as light* as possible. No animals ought to be allowed to enter a bedroom, in an infectious case they may be carriers of disease-germs. A cat lying on an infant's chest has been known to cause death by suffocation. The rat-flea and the bug have been proved to carry infection to Man, *e.g.* Plague.

Under-garments, especially for children, are best made of pure wool. It keeps the body warm because (1) it is a bad conductor of heat and therefore retains it; (2) between its fibres the air already warmed by the heat of the body lodges; (3) when rendered moist by perspiration, evaporation does not take place quickly and the skin is not chilled. Silk is also an excellent article of underwear, and is more comfortable, being softer and lighter, but not so warm as wool. Its high price is a disqualification. Linen and cotton are good conductors of heat, and therefore are liable to remove the body-warmth quickly; and when wet rapid evaporation occurs, and the skin is easily chilled in consequence. They also have the danger of being very inflammable; wool when ignited burns slowly or *smoulders*, whereas these burst into flame. By the Children's Act an open fire-grate is prohibited by Law. Materials composed of a mixture of cotton and wool (the cheaper medium being in the greatest proportion) are also inflammable. "Flannelette" of this kind has caused hundreds of deaths from burning among children, and should never be used. A "non-flam" variety made by soaking in a strong solution of alum, or in a chemical salt, is largely advertised. Repeated washing in time renders it more inflammable, and at its best it is not as good as pure wool for underwear.

Wool, silk, hair, linen, and cotton are easily re-

cognised under the microscope. When purchasing expensive material it is advisable to ask the seller *to state its nature on the receipt.* Any false statement will render him liable to legal proceedings; and a refusal to put down on paper what he willingly states verbally is open to suspicion.

By wearing insufficient or unsuitable clothing, which leaves their arms and legs exposed to cold, numerous deaths are caused among children. Clothing though warm in texture ought to be light and applied fairly loosely round the body. The warmed air will then lie between the clothes and the skin. Tightly-fitting garments and bands not only impede the circulation, but leave no space between the body and the under-garment, and consequently the body-warmth more readily escapes. Garters, corsets, tight sleeves, &c., compress the blood-vessels and nerves, and prevent the organs beneath from fulfilling their functions adequately. The lungs are unable to expand properly when tight-lacing is done; shortness of breath, anæmia, and ill-health result. "Fashionable" corsets constrict the lungs, diaphragm, liver, stomach, and other internal organs, and cause displacements of a very serious nature which may result in dangerous illness; and if persisted in, in death. Free-movement of the body and of the extremities is essential for good health.

Tightly-fitting shoes and boots cause corns, bunions, and deformity of the joints. The human

foot has three points of support—one at the heel and the others at the bases of the great and small toe (Fig. 48). The natural foot, as seen in the infant,

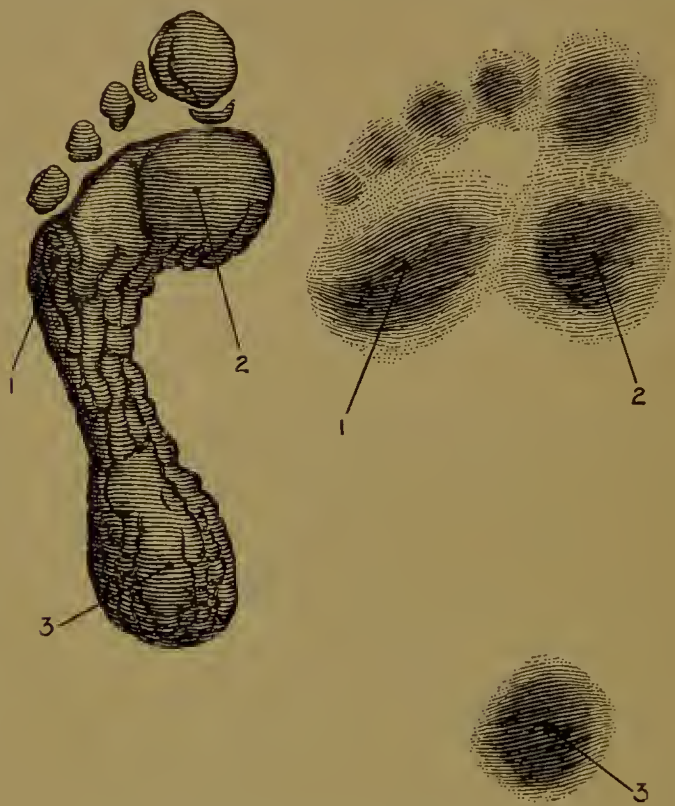

Fig. 48.—Impression of Natural Foot, showing Three Chief Points of Support.

is narrow at the heel and broad towards the bases of the toes, somewhat in the shape of an open fan. The inside of the foot is nearly a straight line from the inner ankle-bone to the side of the big toe (Fig. 49). In the "fashionable" shoe or boot all this is

neglected; the toes are forced together to a point in the central line of the foot, the natural heel is artificially raised by a narrow and pointed one placed in the centre of the sole to give an appearance of smallness to the foot. The weight of the body rests mainly on two points (instead of a minimum of three), *i.e.* on the pointed toe and heel of the shoe. The sloping sole throws the body forwards and causes a distortion of the figure and an unnatural gait,—as ridiculous as it is unhygienic, because it tends to produce displacements internally and discomfort externally.

FIG. 49.—Straight Line on Inner Side of Natural Foot.

The properly-made shoe both for infants and adults ought to have a *low* and a *broad* heel (such as is worn by jockeys), an almost straight inner line (of the sole) from heel to great toe, and fairly rounded and broad "tips" so that the toes can expand on walking. Babies' shoes are now being suitably shaped by several firms, and instead of those which were pointed, and made to "fit" *either* foot, we have them accu-

rately constructed for *each* foot so that interchange is impossible.

Stockings are also wrongly made—coming to a point at the toes instead of widening there. They can be obtained of a pattern like a glove, each toe having a separate compartment, such as are worn on the stage to convey the idea of bare feet.

Highly coloured stockings may contain poisonous metallic (arsenic and lead) and aniline dyes, and these often cause irritation and even alarming symptoms before their nature is discovered.

Exercise.—Suitable exercise is essential to the maintenance of health. The crying, "crowing" and kicking of the infant are Nature's methods of exercising the lungs and muscles. Too early attempts at walking are to be discouraged because they may lead to bending of the soft bones of the foot and leg or to distortion of the spine—particularly so in rickety or weakly children. Later in life gymnastics, cricket, and football for boys are useful to strengthen muscle, bone, and brain, but all such violent exercises ought to be preceded by a medical examination of the heart and lungs. "Paper-chases" of long duration, and all violent sports for young lads, occasion too great a strain on the system before it is matured, and the modern tendency in School, College, and University is to make a "business of pleasure." Such forcing of athletics on young people who are

physically unfit or constitutionally disinclined for them is a common mistake.

For girls and boys Swedish drill and breathing exercises are useful *if not carried too far.* Tennis, fencing, skating, swimming, walking and riding are excellent for all. Violent "athletics" for young women such as the vaulting-horse and heavy dumb-bell exercise are capable of doing much harm. There is to be "moderation in all things," and one must not forget that both anatomical and physiological differences exist which no amount of theory and practice will set aside or overcome. Amusements must be made suitable to the requirements of age and sex. To excite the imagination of the young, and the susceptibilities of those who are older, in an unhealthy manner, cannot but be unwise. The rule must be "*mens sana in corpore sano*"—a sound mind in a sound body.

Sleep.—The infant needs as much as can be naturally obtained; during the first year of age about 16 hours in the 24. Children up to 10 years of age require about 12 hours sleep during the night, and those aged 12 or 13 about 9 or 10 hours. The adult needs about 8 hours, and in old age does fairly well on much less because there is less work of mind and body done, and therefore less strain to recover from, but after exertion there is greater general weakness, and less feeling of refreshment after repose.

The growing child and the adolescent require a *proportionately* larger amount of food, drink, and sleep than the fully-developed adult, because the body is being built up and is not only "kept in a state of repair." This is a fact which parents, nurses, and school-masters seem to lose sight of when they restrict too much the supply of food. It explains why boys are able to assimilate large meals without discomfort.

Owing to the wide advertisement of various "patent" foods, drinks, and drugs in a manner calculated to secure a large sale and a good profit for the vendors, the Public has a desire to dose itself both in health and in illness. In this way so-called "foods" and worthless or dangerous compounds for the "cure" of all kinds of disease are taken, and result in ill-health, or in a false sense of security which may prevent proper treatment being adopted until it is too late.

That an educated Public can be deceived by such "quacks" and impostors who have everything to gain and nothing to lose (so long as the Law is not amended) is one of the marvels of the twentieth century. It is a Nurse's duty to explain to people the dangers of self-treatment and the risks they run in taking drugs the effects of which they little know: "what is one man's food is another man's poison."

In conclusion: the Nurse's work is concerned

with Hygiene as well as with sickness. It is for her to watch over those who are ill; but also to have a regard for those who are well, so that they may remain so. She comes in contact with all grades of Society in their own homes, of which she for a time becomes a member. She may hear and see what the Physician never comes to know; and she is able to give kindly advice on matters about which he is seldom consulted. Herein lies her great opportunity for influencing those around her for their own good. In her special sphere of work Woman is unapproachable, and Scott has truly said of her:

> "When pain and anguish wring the brow,
> A ministering Angel thou!"

The Nurse will meet with some who are ignorant, with others who resist "interference" and are intolerant of "new ideas." Here tact and persuasion will stand her in good stead. Let her do her duty, striving for the preservation of Health as well as for the cure of Disease; let her "speak kindly to the erring," and she will by so doing influence others around her to follow in her footsteps—

> "Footsteps, that perhaps another,
> Sailing o'er Life's solemn main,
> A forlorn and ship-wrecked brother
> Seeing, shall take heart again!"

APPENDIX

IMPORTANT ACTS OF PARLIAMENT, &c., RELATING TO PUBLIC HEALTH

Vaccination

England and Wales.—The parent, guardian, or other person in charge of a child *must have it vaccinated within six months* of birth by any General Practitioner or by the Public Vaccinator of the district. If not vaccinated within four months the Public Vaccinator gives notice and visits the house offering to vaccinate.

Should any objection be made to vaccination, a statutory declaration must be made by the parent, &c., before a Commissioner of Oaths (at his own cost) *within four months* from birth, and it must be sent to the Vaccination Officer within seven days. In it he must state that he consistently believes vaccination to be prejudicial to the health of the child.

Scotland.—Vaccination must be done within six months of birth. A statutory declaration must be made within the same period, and is to be forwarded to the Registrar of the district within seven days.

Ireland. — Vaccination is compulsory within three months of birth.

Both the Public Vaccinator and the Vaccination Officer are appointed and paid by the Guardians in Unions and Parishes. The former vaccinates, and the latter keeps the books, &c.

Infectious Diseases Prevention Act

England and Wales, and London[1]

The Sanitary Authority must serve notice upon the occupier of any house to disinfect it and contaminated articles if the Officer of Health or a medical practitioner certifies that it is desirable.

Infected bedding can be destroyed and the owner compensated. On the certificate of a qualified medical man a Justice of the Peace may order the removal of any person having a dangerous infectious disorder who is without proper lodging. Penalty for disobedience or obstruction £10.

A person wilfully exposing himself while suffering from a dangerous infectious disease without taking proper precautions against spreading infection in any street, public place, inn or *public conveyance*, or entering any public conveyance without proper notice of his condition to the conductor or driver; or who *being in charge of any infected person exposes him;* or who lends, sells, transmits, or exposes, unless disinfected, or on the way to be disinfected, any infected bedding, clothing, rags, &c. Public conveyances so used must be thoroughly disinfected. Penalty £5. No person must let or hire any infected house or part of it until it is disinfected to the certified satisfaction of a medical practitioner. Penalty £20.

For hiring or offering for hire any house, or returning a false answer when asked concerning the existence

[1] London has a Public Health Act separate from that for "England and Wales," and several other Laws in force in the Metropolis are not so elsewhere,

Scotland and Ireland have Acts of their own.

in it of infectious disease within the previous six weeks, the penalty is £20 or imprisonment for one month.

A Medical Officer of Health may stop the supply of milk from an infected dairy after investigating the matter.

The body of a person dying from an infectious disease must be removed after 48 hours at most to a mortuary or to a room not used as a dwelling or sleeping place or workroom, unless the Health Officer or a medical practitioner gives permission for it to remain. If the retention of *any* body is likely to injure the health of a household or of the neighbours, any Justice of the Peace, on the application of the Health Officer, may order its removal and burial in a fixed time. In a case of urgency this may be done immediately.

For exposing infected articles or for throwing them into an ashpit the fine is £5.

Scotland and Ireland

The Laws for Scotland and Ireland are practically the same as the above.

INFECTIOUS DISEASES NOTIFICATION ACT

Compulsory in England and Wales; London; and Scotland. Adoptive (Optional) in Ireland.

Diseases to be notified: Small-pox, Cholera, Diphtheria, Membranous Croup, Erysipelas, Scarlatina or Scarlet Fever, Typhus Fever, Enteric or Typhoid Fever; Relapsing, Continued, and Puerperal Fevers, or any other Infectious Disease which the Sanitary Authority may add.

Notification is to be made when any of the above Diseases exists in any building used for human habitation, including tents, vans, and ships.

The persons by whom notification is to be made as soon

as they are aware that the person is suffering from a notifiable disease are: (1) The head of the patient's family, *or* (2) the nearest relative, *or* (3) persons present in the building, *or* (4) *in attendance on the patient*, *or* (5) the occupier of the building.

Notice is to be given by the persons named *to the Medical Officer of Health of the district.* Penalty 40s. (Exemption from fine on proving that there was cause for believing that the notification had already been made.)

In London: Cerebro-spinal- and Posterior Basic Meningitis, Chicken-pox, and Ophthalmia Neonatorum are temporarily notifiable.

In England and Wales: Tubercule of the Lung in the Poor-law Institutions and Hospitals (p. 160). Notification is made to the local Medical Officer of Health.

The Children's Act

Is intended to protect children and young persons, Reformatory and Industrial Schools and juvenile offenders. It applies to England, Scotland, and Ireland.

Notice must be sent in writing to the Local Authority (County or District Council, &c.) within 48 hours:—

(1) By persons who are paid for taking charge of *one or more* children under 7 years of age apart from their parents or having no parents. (This notice must state name, sex, date and place of birth of the child, name and address of the person receiving it, and of the person from whom it was received.)

(2) Any change of address of those in charge of the infant.

(3) If the infant dies or is removed to the care of some one else (giving new address).

(4) To the Coroner, in all cases of death; he will order an inquest if there is no medical certificate.

Notices must be sent by registered letter to the Clerk of the Local Authority :—

If the child is kept in overcrowded, dangerous, or insanitary premises, or by persons who are negligent, ignorant, drunken, &c., and therefore unfit to take care of it, the infant can be removed by the Local Authority.

The lives of the infants *must not be insured* by taking out a Policy, so as to obtain money at their death.

The Act protects against "farming" children, and does not apply to relations. Inspectors, medical women, or qualified nurses (in Hygiene) are appointed Visitors, and any infringements of the Law or misleading statements are *severely punished* for any of the following :—

Cruelty to children.

Persons over the age of 16 (including parents *and nurses*) who ill-treat, assault, neglect, or expose children in such a way as to cause unnecessary suffering or injury to health.

Any person over 16 having the care of a child under 7 years of age who *allows it to be in a room with an open fire not properly protected by a fire-guard*, and without taking proper precautions.

"Overlying" children under the age of 3 years, even if this be done unknowingly under the influence of drink.

Allowing children to be in a filthy and verminous state—this is important for Nurses attending on school-children.

Smoking among young children.

Taking children to the bar of a Public-house or sending them there to buy drink.

The Care of School-Children

Under the Education Act of 1907 a national system of medical inspection and supervision of school-children throughout England and Scotland was established by Law.

In England and Wales this is done by the Board of Education (London) and in Scotland by the Education Department (Edinburgh).

Every local Education Authority must appoint a medical inspector who is either the Medical Officer of Health himself or a special school medical officer who works with him. A Hospital-qualified School-nurse is also selected, *especially one trained in Hygiene*, and she works under them, and assists in the supervision and inspection of the children as regards their health, bodily condition, their cleanliness or otherwise, the possibility of infection, and the early detection of symptoms of disease. It may be her duty to pay house-to-house visits among the parents of the children, and when this is not possible for the School-nurse *it has been suggested that the District Nurse should be employed for this work.*

The Nurse in charge of the children may have, under the sanction of the Board, to attend to slight ailments and injuries, and she may also be employed in taking the children home, especially those who are defective in intellect, or suffer from Epilepsy. For these cases special ambulance-carriages have been provided. It is most important for her to find out if any child is coming from an infectious place; to notice if any have suppurating ears, enlarged tonsils or adenoids, bad teeth, unclean heads, clothes, or habits. The presence of ringworm, itch or any other skin-disease is to be looked for and immediately reported to the School Medical Officer and Head Teacher, with whom she should be in constant communication.

A Nurse may also be required to give simple instruction in personal Hygiene and in breathing-exercises to the children. Lady school-teachers are now receiving such instruction also.

A Nurse with "tact," and one having a persuasive

power, and not an aggressive one, will be able to exert an enormous influence for good over parents and children "who know not what they do."

The Midwives Act

It is intended to provide for the safety of cases by preventing unqualified attendance, and also to control the spread of disease.

The Local Authority is the County or Borough Council, and the rules are made by the Central Midwives Board. Under this Act: all midwives must be registered and a general supervision is exercised over all practising within the local area; charges of negligence, misconduct, &c., are investigated by the Local Authority and reported to the Central Board, and a midwife may be stopped from practising. The midwife must send a notice to the Local Authority when any of the following occur: (1) If mother or child dies without having been seen by a Registered medical practitioner; (2) if the child is still-born; (3) if owing to complications at or after labour it has been necessary to ask for medical assistance. Stamped and addressed post-cards are supplied gratis locally.

The Local Authority inspects the midwife's case-book, instruments, appliances, and if necessary her residence and method of work.

Disinfection.—If she has attended a case of Puerperal Fever, or of *any other illness supposed to be infectious*, she must disinfect *herself*, *all her instruments* and other appliances to the satisfaction of the Authority, and must have *all her clothing disinfected before going to another labour. Washable clothing is to be boiled;* and other clothing will be disinfected by the Sanitary Authority.

Registration of Births

Note that in default of the father and mother it is the duty of other persons (including the Medical Adviser and the Nurse) who have been present at the birth to give notice to the *Registrar of Births and Deaths* of the district *within forty-two days*, and to sign the Register in his presence.

Where the Notification of Births Act is in force, information must also be given *in writing* to the *Medical Officer of Health within thirty-six hours after birth.* It is the duty of *any person who has been in attendance within six hours of the birth* to give this notice. For failing to do so a fine can be imposed, but if it can be proved that it was supposed the notice had been given by another, no penalty follows.

By applying to the Medical Officer of Health of the place Nurses within their own area will obtain, without charge, stamped and addressed post-cards having the form of notice printed on them.

This applies in England and Wales, London, Scotland and Ireland.

Notification of Deaths

This must be made to the Registrar of Births and Deaths of the district *within five days* by the nearest relative who was present at the time or *who was in attendance* during the last illness. In default of such person the Medical Attendant must give the notice.

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THE END

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